

# Monitoring of Hurricane Gordon using NWCSAF MSG-satellite products

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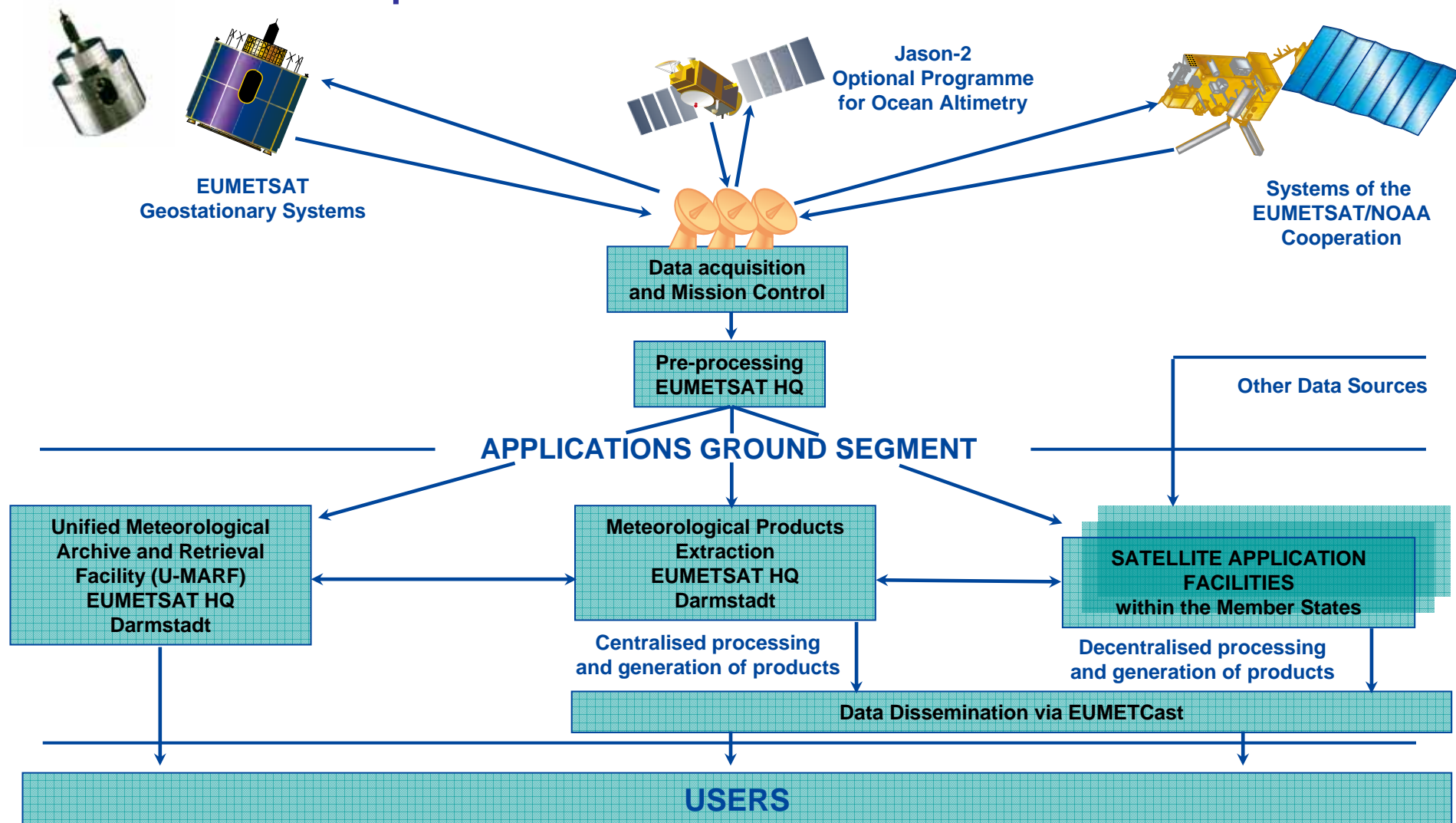
Workshop on subtropical cyclones  
and extratropical transitions  
8-9 May 2008  
Madrid

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  - SAF on Nowcasting
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- Summary & outlook

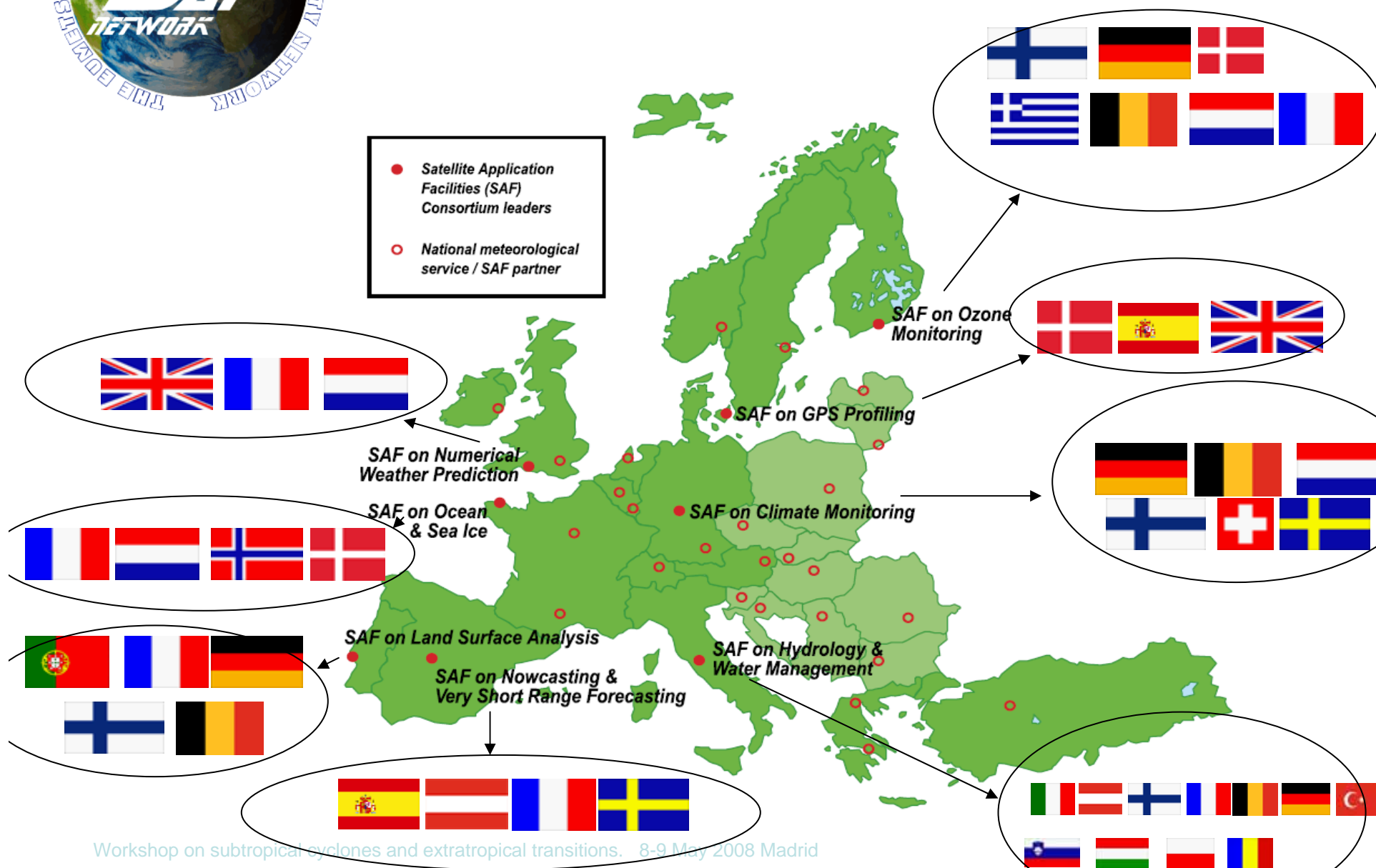
# EUMETSAT system

## Distributed process between MPEF and SAFs network





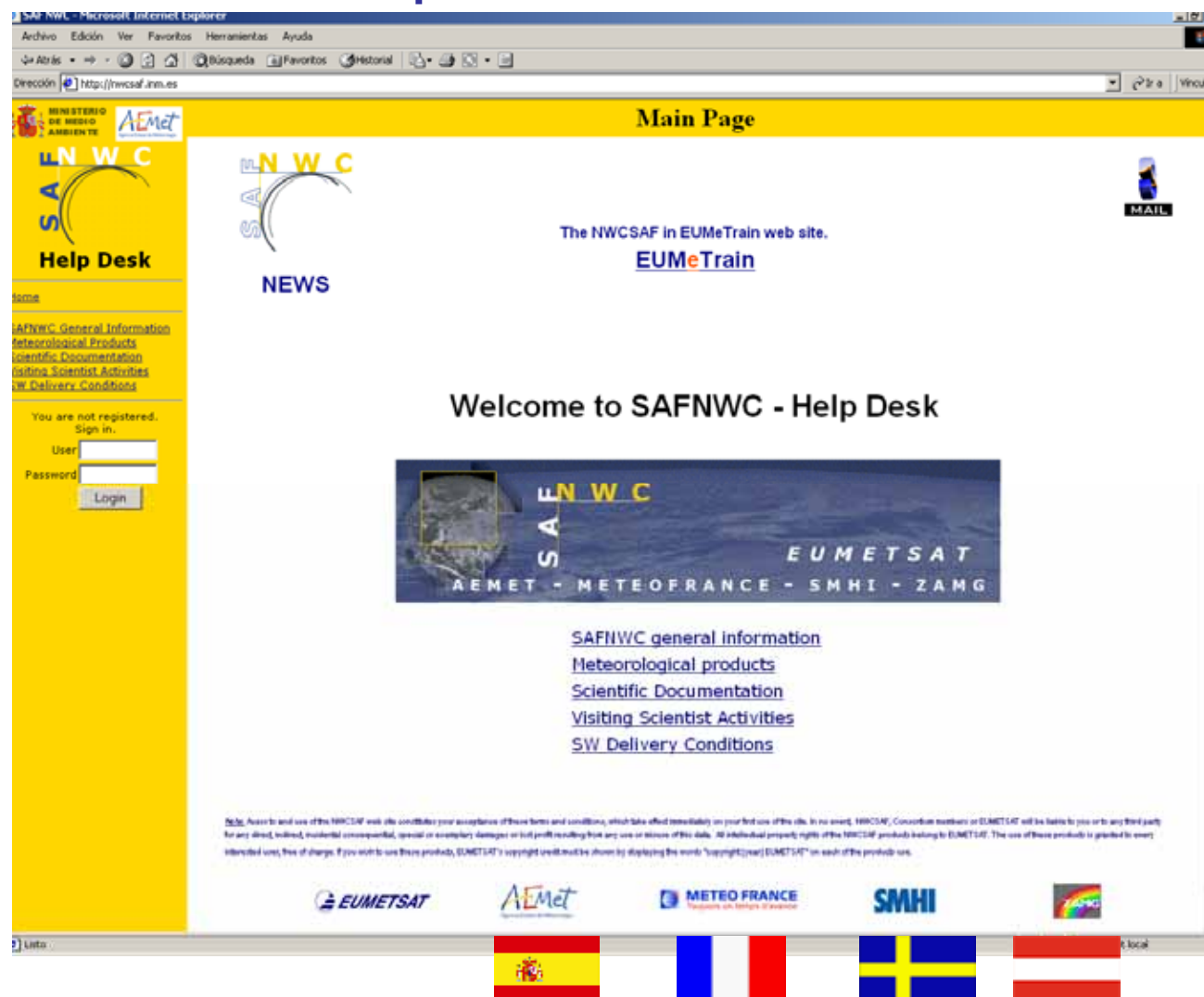
# SAFs network





# NOWCASTING SAF

<http://nwcsaf.inm.es>



# NWCSAF purpose

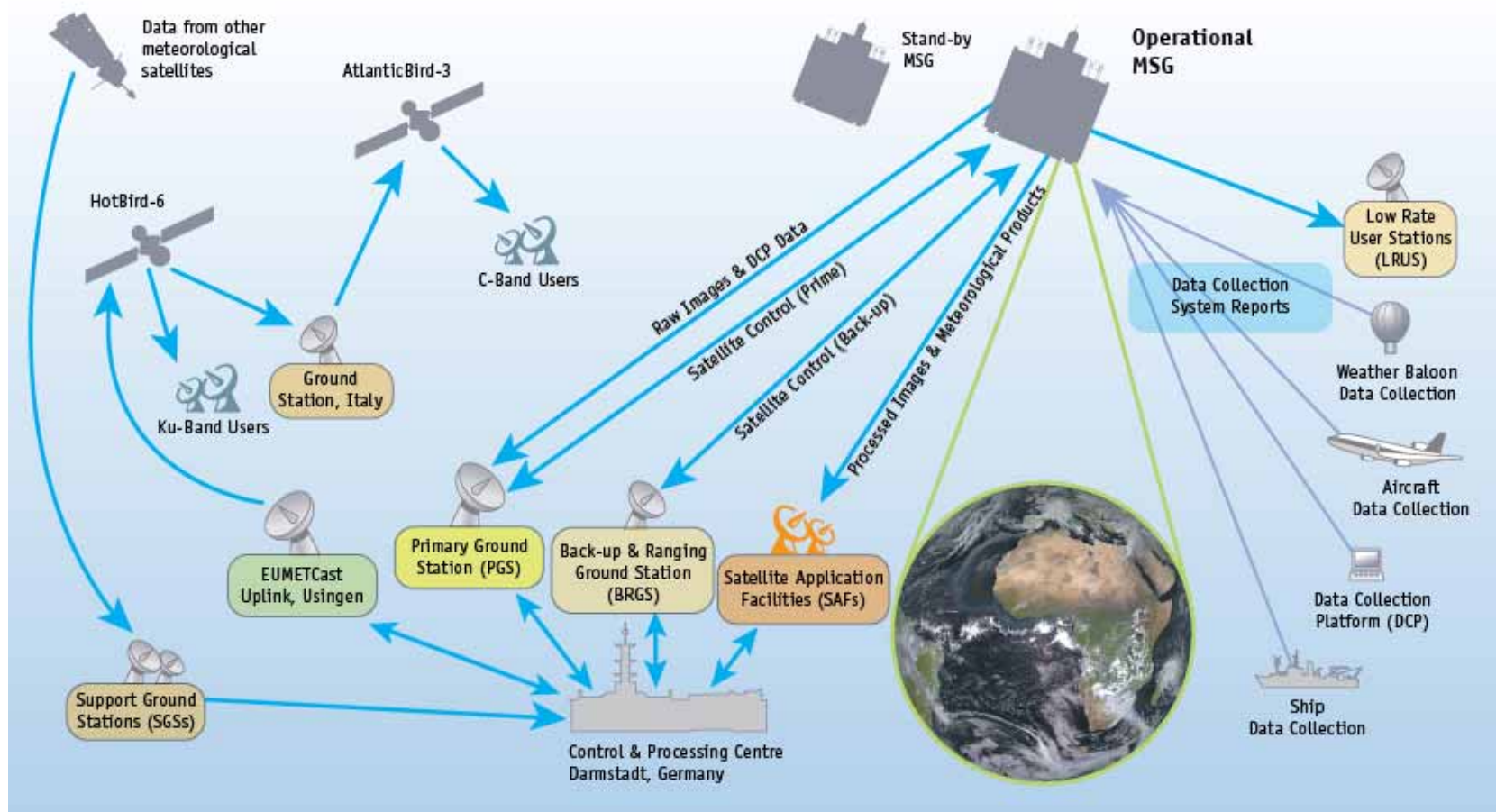


EUMETSAT Satellite Application Facilities  
for Nowcasting and Very Short Range  
Forecasting (NWCSAF)

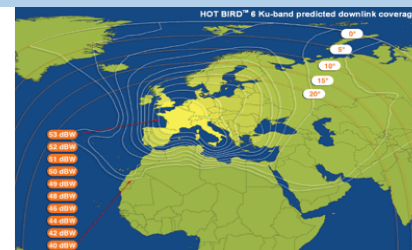
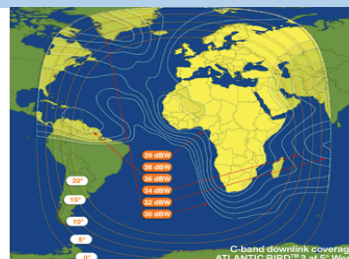
Develop Software packages MSG

- Near Real Time (NRT)
- Full resolution (3km x 3km at Nadir)
- Frequency to be selected by the user (default every repeat cycle 15 minutes)
- Region to be selected by the user

# MSG dissemination by EUMETCast



Foot-print Atlantic Bird,  
C Band



Foot-print HotBird,  
Ku Band

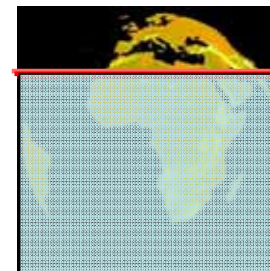
# Software description

NWCSAF software automatically launches the generation of all products following an established order (first Cloud Mask product) after reception the new image.

**PGE??**   **YYYYMMDDHHmm**   **configuration\_file**   **region\_to\_process**








**Nominal Position**  
**0 °W METEOSAT-9**  
**Repeating cycle 15 minutes**



**Rapid Scan region**

**Position 9.5 °E METEOSAT-8**  
**May 2008 (Rapid Scan)**  
**Repeating cycle 5 minutes**

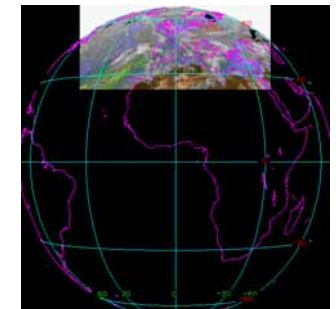
# SAFNWC Products

No.	Product Name (Acronym)	Characteristics	Institute
1	Cloud Mask and Cloud Amount (CMA)	Cloud products	
2	Cloud Type (CT)	Cloud products	
3	Cloud Top Temperature/ Height (CTTH)	Cloud product	
4	Precipitating Clouds (PC)	Precipitation product	
5	Convective Rainfall Rate (CRR)	Precipitation product	
6	Total Precipitable Water (TPW)	Air mass product	
7	Layer Precipitable Water (LPW)	Air mass product	
8	Stability Analysis Imagery (SAI)	Air mass product	
9	High resolution Wind from HRVIS (HRW)	Wind product	
10	Automatic Satellite Image Interpretation (ASII)	Thunderstorm product	
11	Rapidly Developing Thunderstorm (RDT)	Conceptual Models product	
12	Air Mass Analysis (AMA)	Air mass products	

**Cloud Products: CMA, CT and CTTH.**

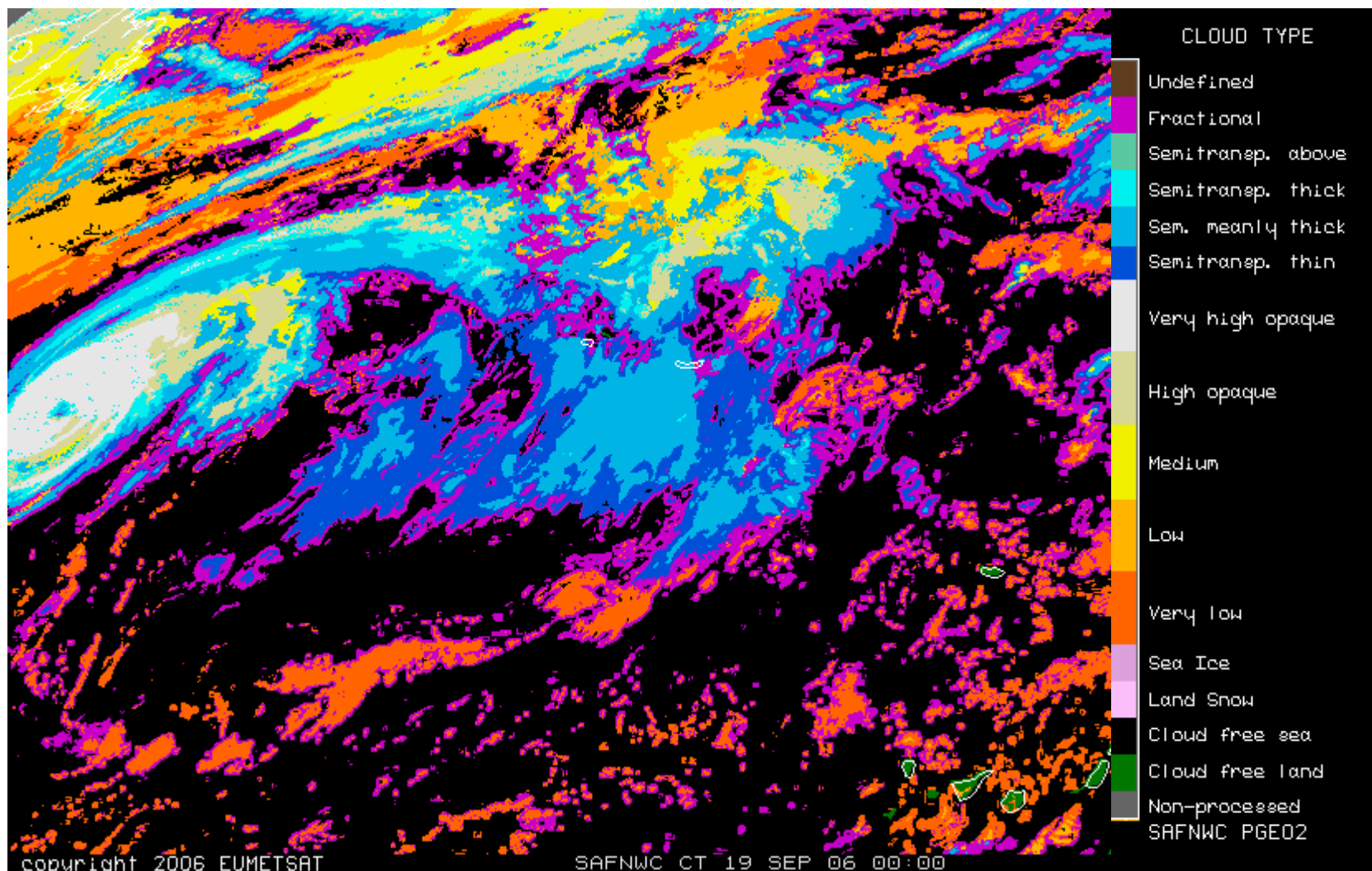
**Precipitation Products: PC and CRR.**

**Air Mass Products: TPW, LPW, SAI and AMA.**



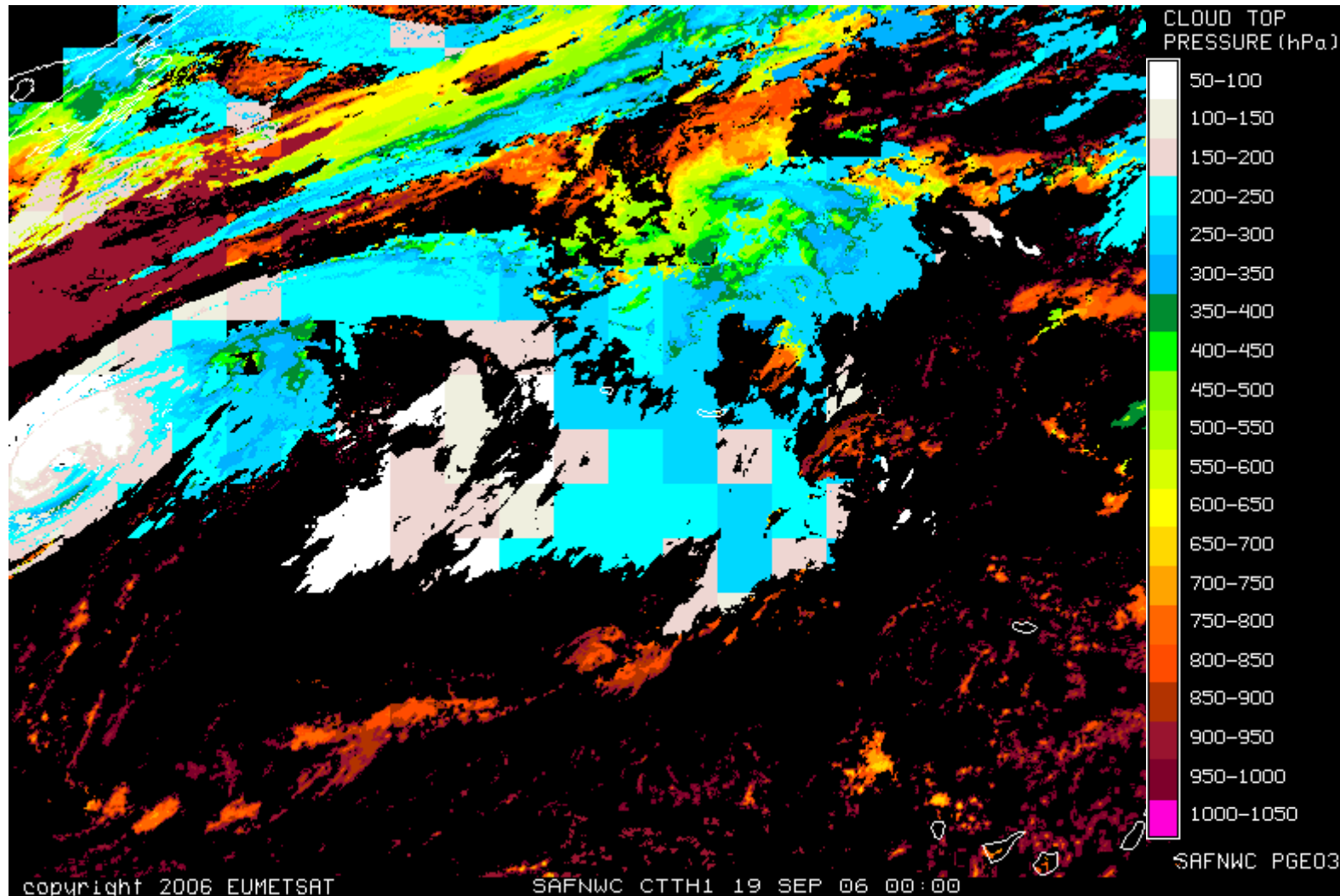


# Cloud products CT (Cloud Type)



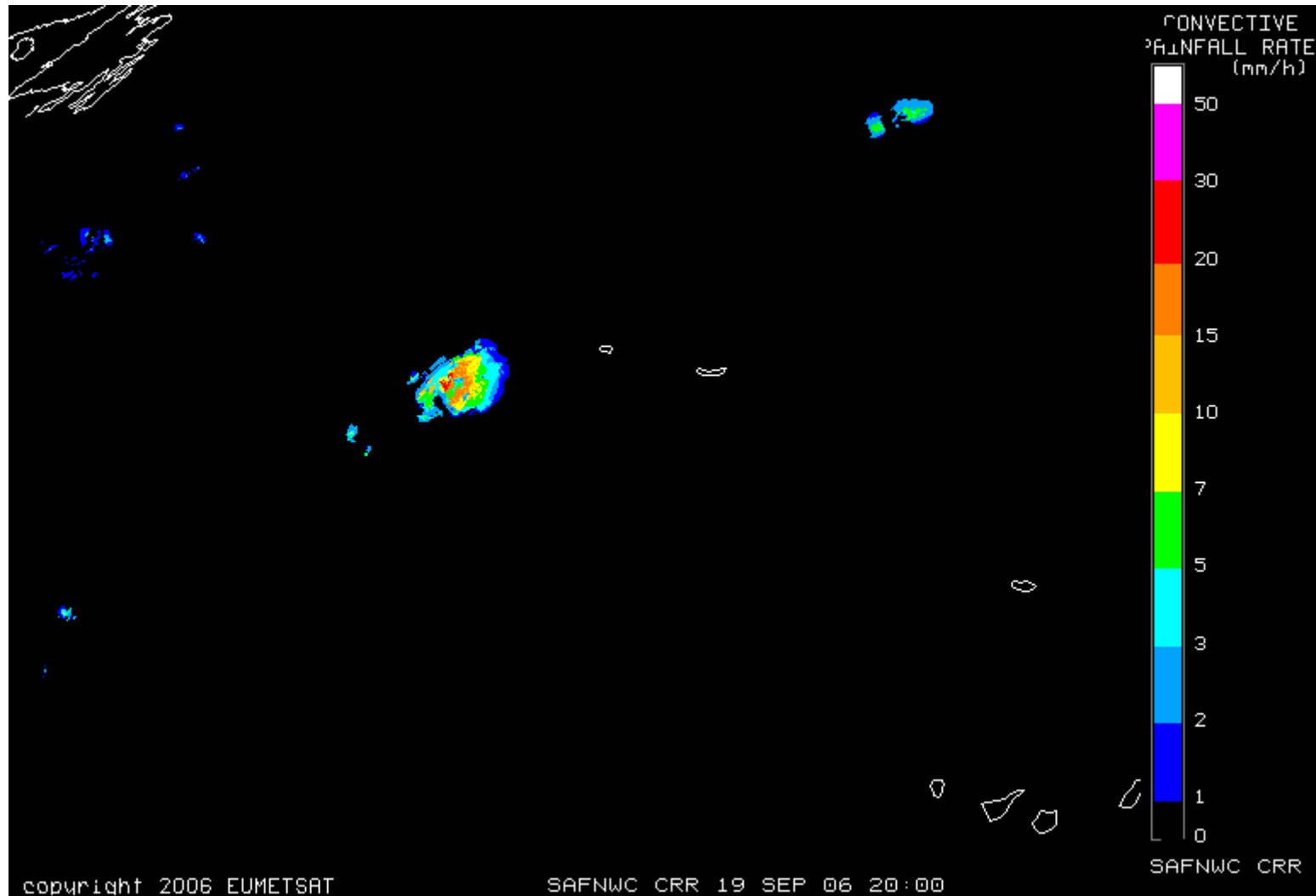
# Cloud products CTTH

(Cloud Top Temperature/height)



# Precipitation products CRR

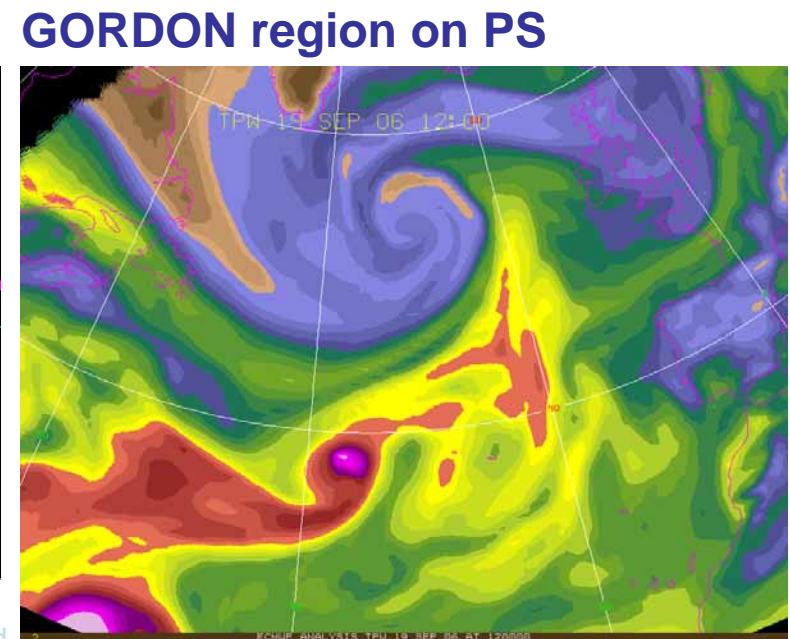
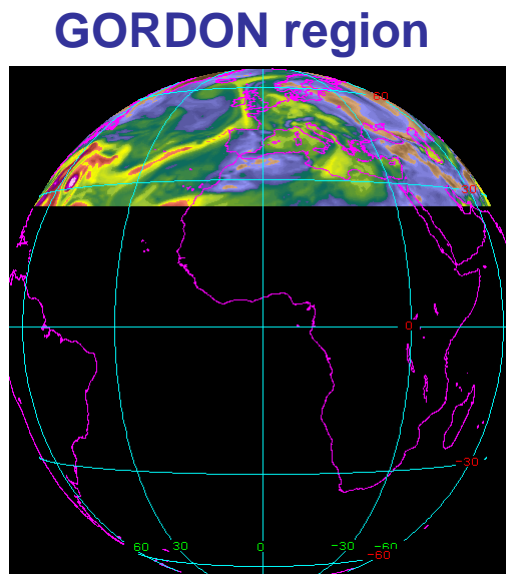
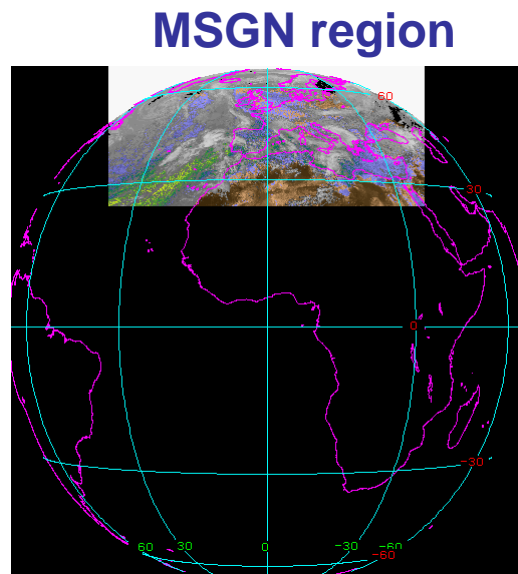
(Convective Rainfall Rate)





# Clear air products (TPW, LPW, SAI)

- For these products the algorithms have been reprocessed for a wider area, therefore GORDON is monitored during more time.
- The images have been reprojected to PS (Polar stereographic) projection.



# Retrieved air clear parameters (2008)

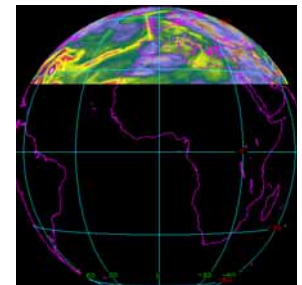
- TPW is the amount of liquid water, in mm, if all the atmospheric water vapour in the column was condensed.
- LPW provides information on the water vapor contained in a vertical column of unit cross-section area in three layers in the troposphere:
  - Boundary Layer (BL): 1013hPa-840 hPa
  - Middle Layer (ML): 840hPa-437hPa
  - High Layer (HL): <437hPa

Note: RTTOV pressure levels

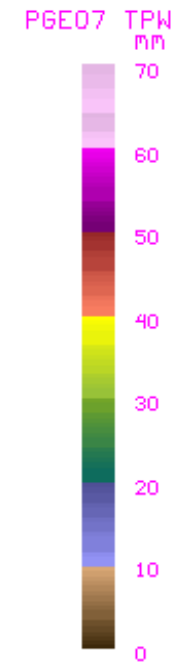
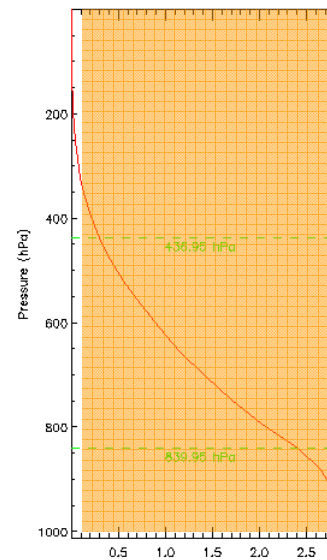
- SAI provides estimations of the atmospheric stability in cloud-free areas. Among all the potential indexes, the Lifted Index (LI) has been implemented and coded.

$$LI = T(500\text{-hPa environment}) - T(500\text{-hPa parcel}) \text{ (in } ^\circ\text{C)}$$

**Algorithm: statistical retrieval based on neural networks**



# GORDON Hurricane NWCSAF/MSG TPW images



PGE07 TPW

mm

70

60

50

40

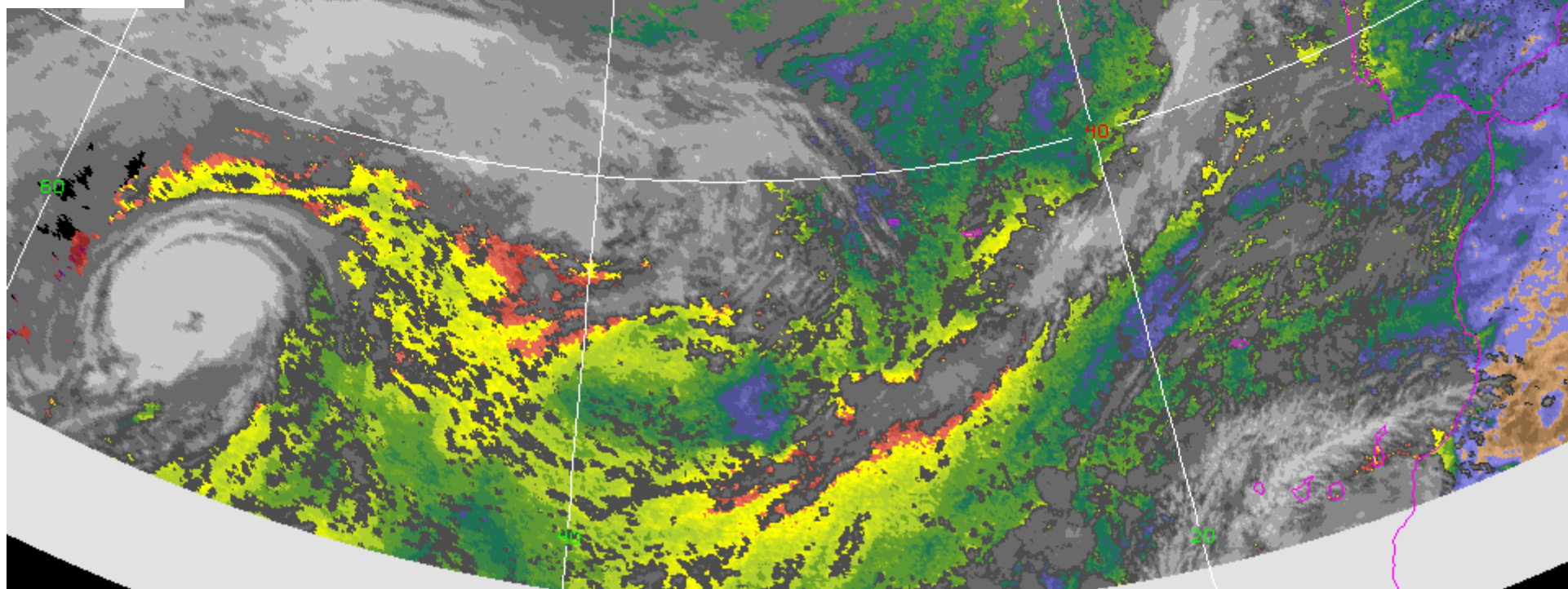
30

20

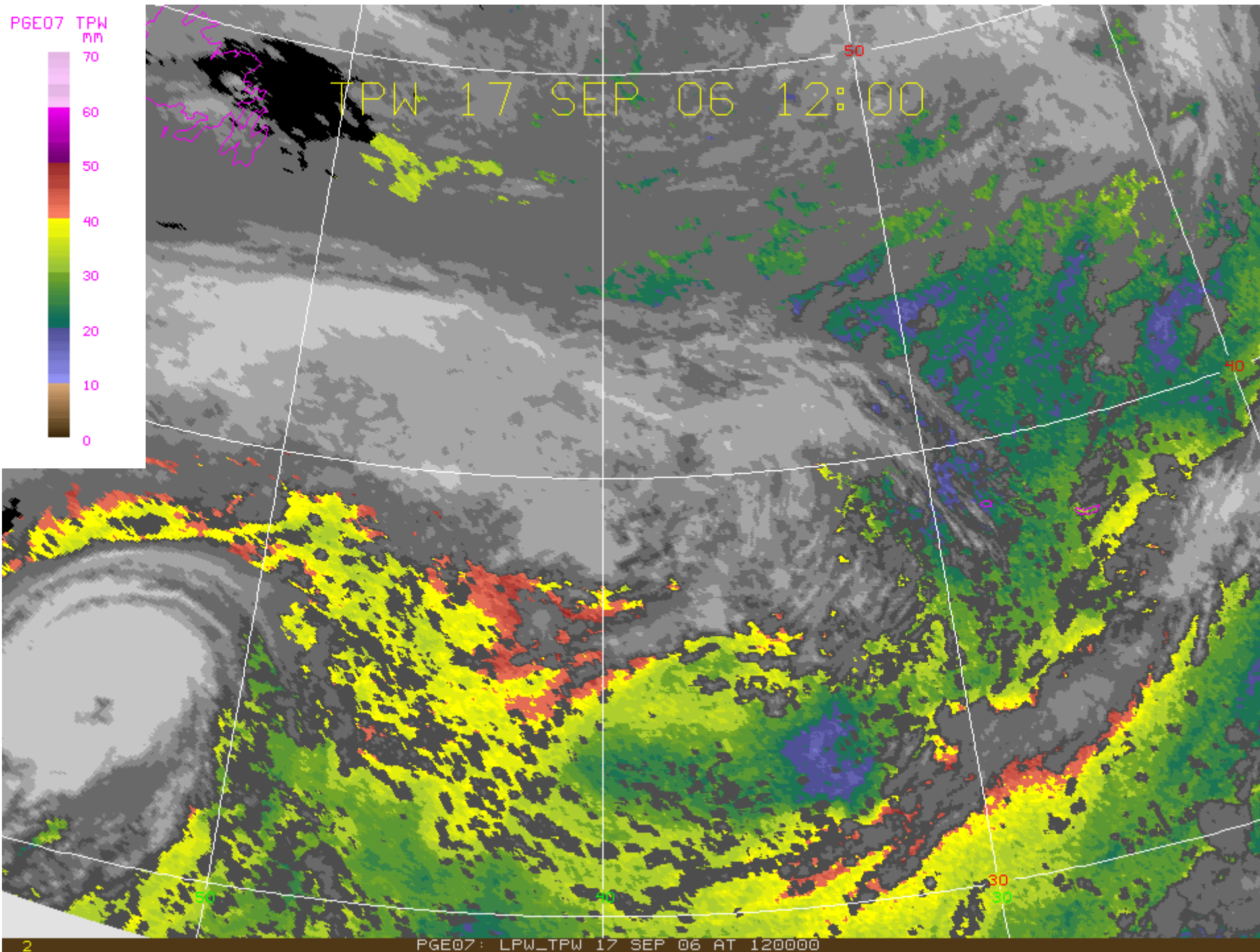
10

0

TPW 17 SEP 06 12:00

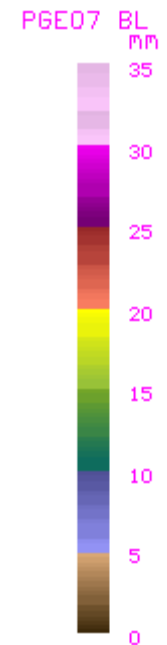
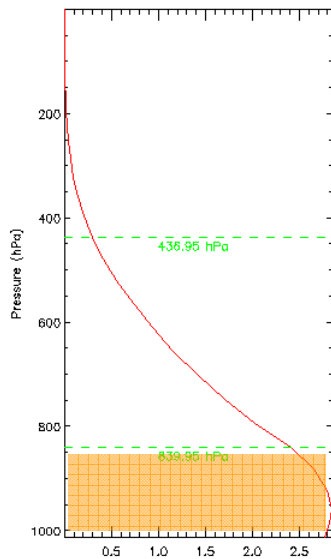






# GORDON Hurricane NWCSAF/MSG BL images

Boundary Layer (BL)  
(1013hPa-840 hPa)



PGE07 BL

mm

35

30

25

20

15

10

5

0

BL 17 SEP 06 12:00

50

40

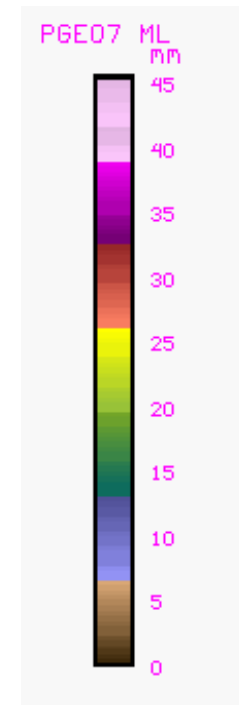
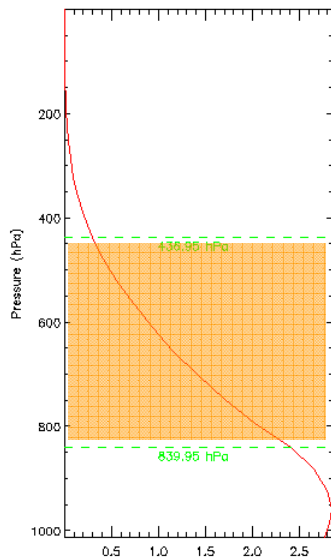
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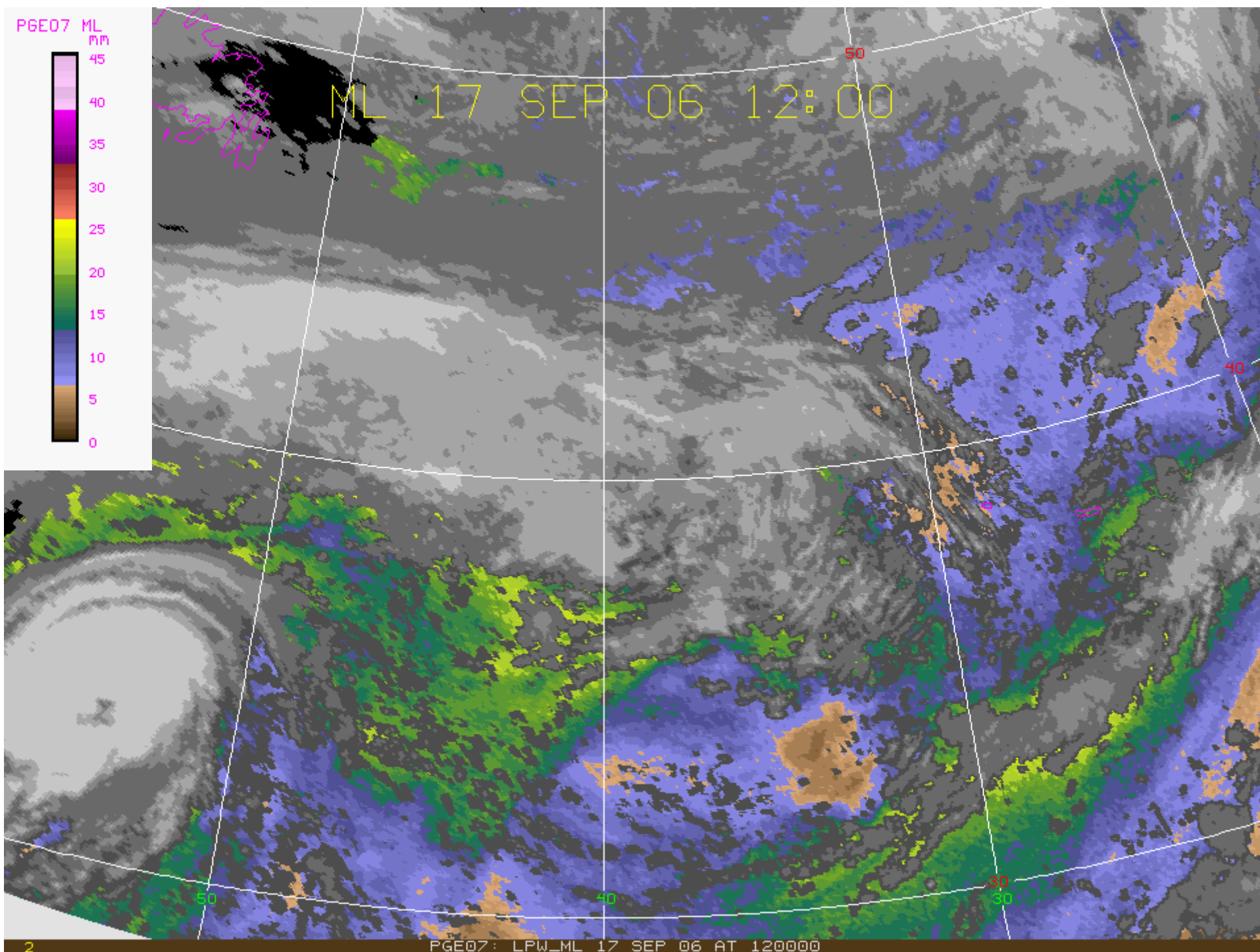
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# GORDON Hurricane NWCSAF/MSG ML images

Middle Layer (ML)  
(840hPa-437hPa)

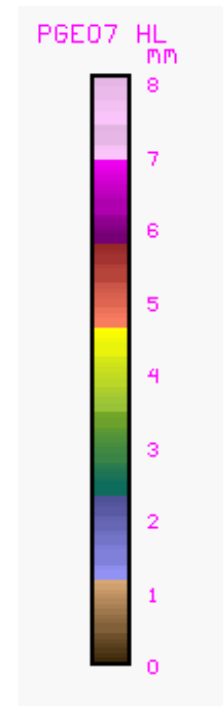
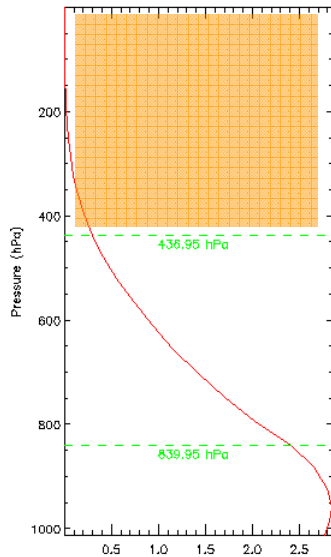


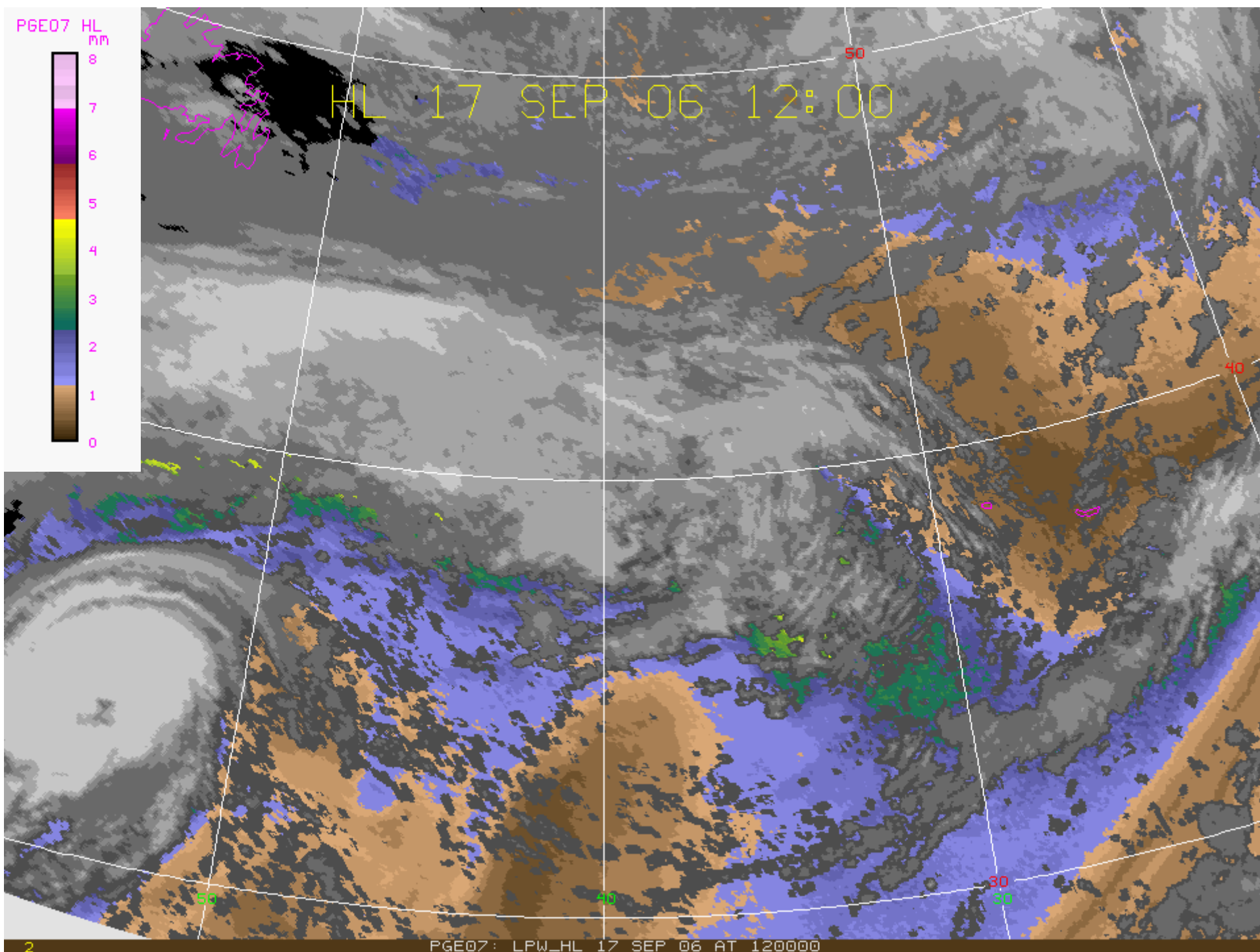




# GORDON Hurricane NWCSAF/MSG HL images

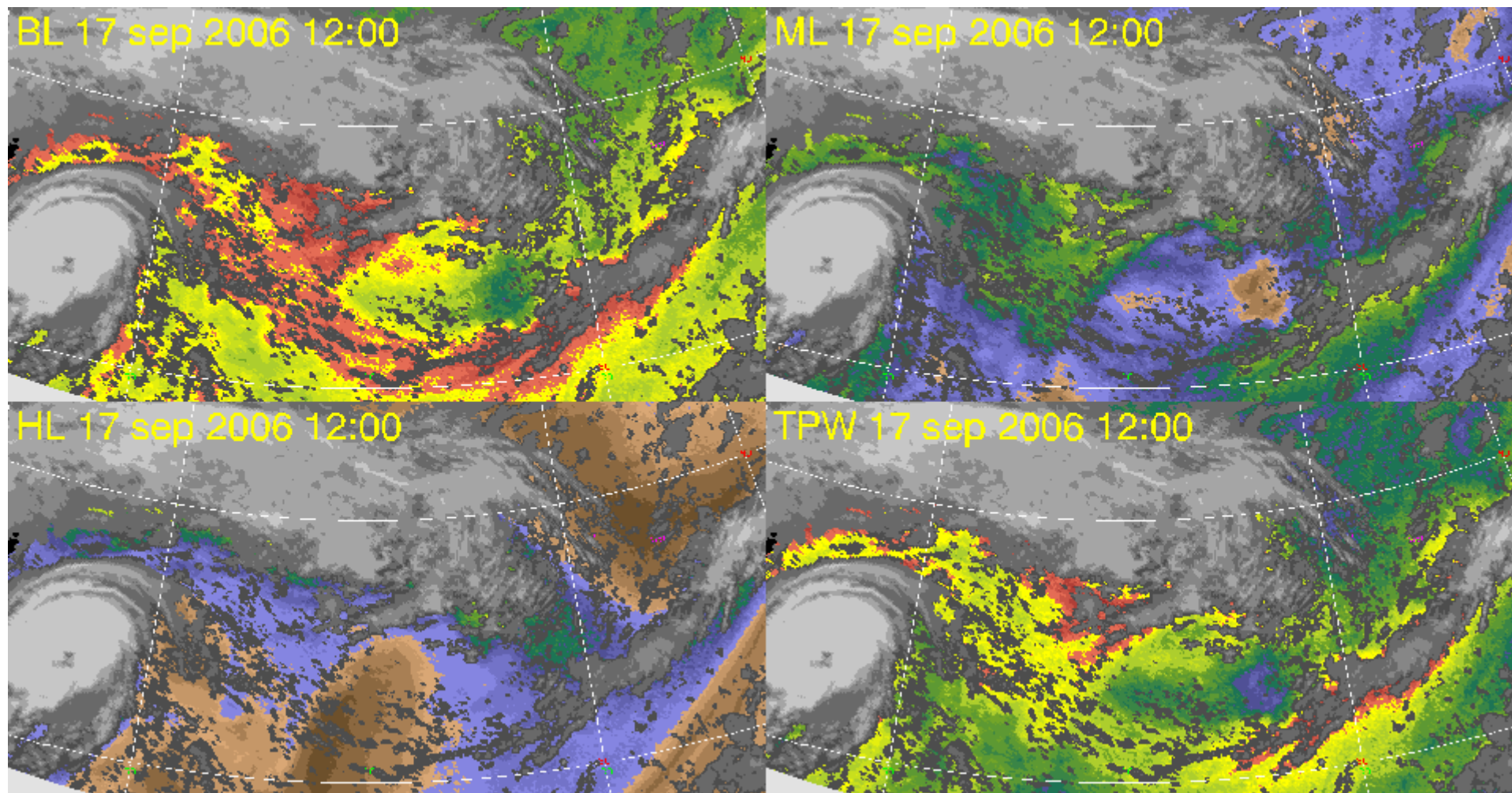
High Layer (HL)  
( $P < 437\text{hPa}$ )







# Combined images



# New sub-layers splitting of ML around 700 hPa

LPW Parameter	Bottom level	Top level
BL	SFC	840 hPa
ML	840 hPa	437 hPa
HL	437 hPa	0 hPa

**RTTOV  
levels**

## SPLITTING OF THE MIDDLE LAYER

LPW\_M1  
(840-703)

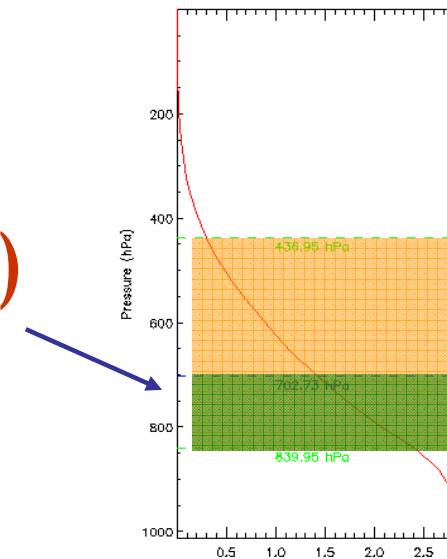
LPW\_M2  
(703-437)

**The Middle Layer of LPW NWCSAF/MSG satellite product has been split in two new sub-layers.**

# GORDON Hurricane NWCSAF/MSG M1 images



M1  
(840hPa-703 hPa)



PGE07 M1

mm

15

10

5

0

M1 17 SEP 06 12:00

50

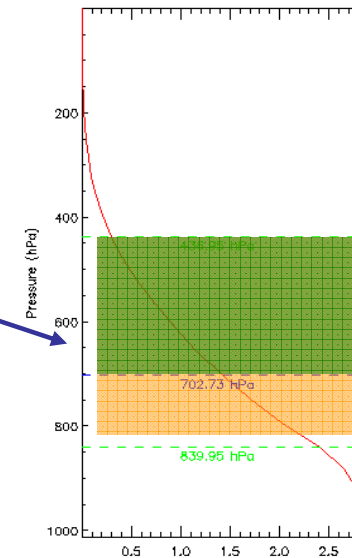
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30

# GORDON Hurricane NWCSAF/MSG M2 images



M2  
(703 hPa-437hPa)





PGE07 M2

mm

15

10

5

0

M2 17 SEP 06 12:00

50

40

30

# GORDON Hurricane NWCSAF/MSG SAI

SAI provides estimations of the atmospheric stability in cloud-free areas. Among all the potential indexes, the Lifted Index (LI) has been implemented and coded.

$$LI = T (500\text{-hPa environment}) - T (500\text{-hPa parcel}) \text{ (in } ^\circ\text{C)}$$



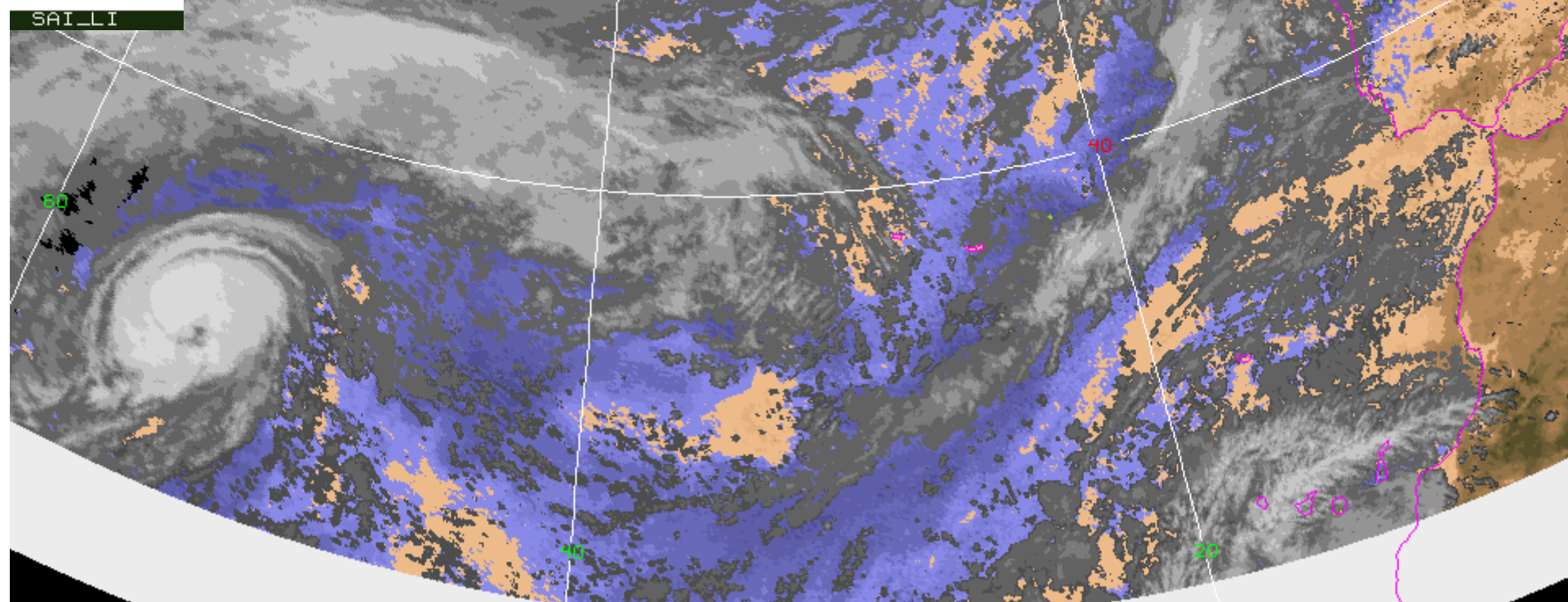
SAI\_LI

PGE08 SAILI  
LI(°C)

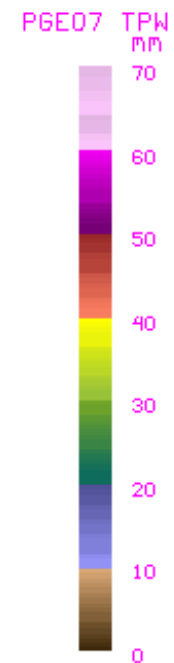


SAI 17 SEP 06 12:00

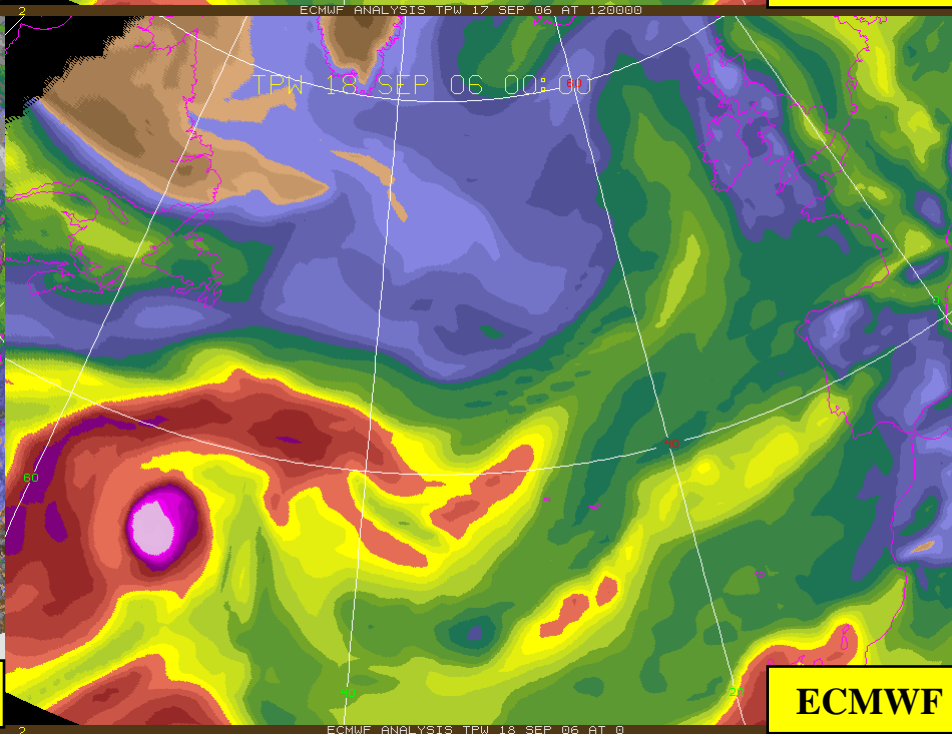
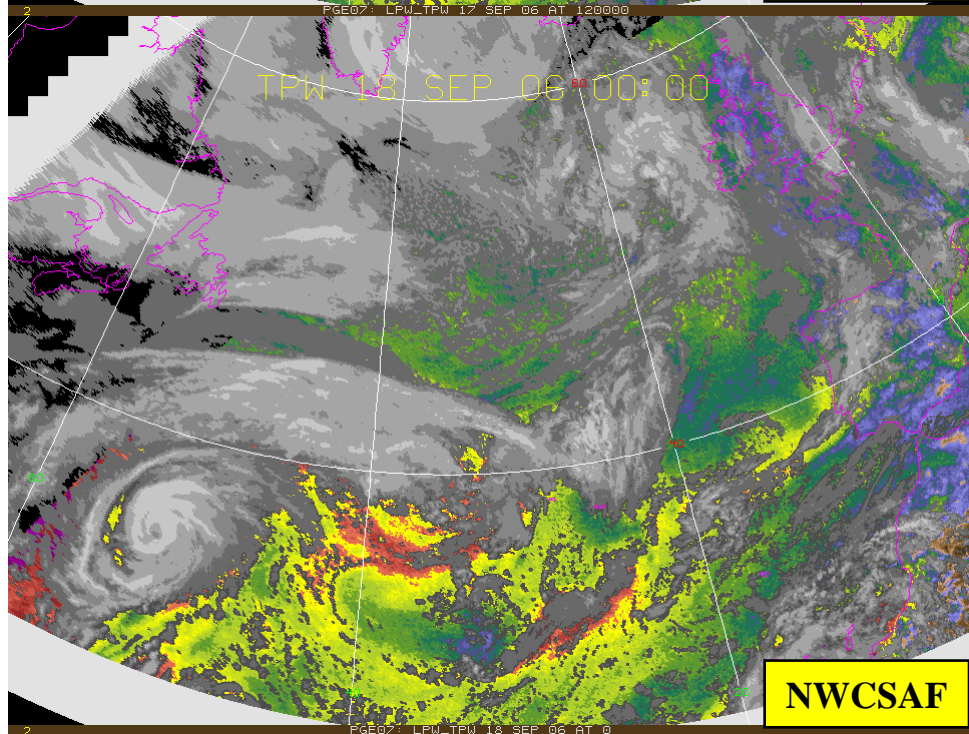
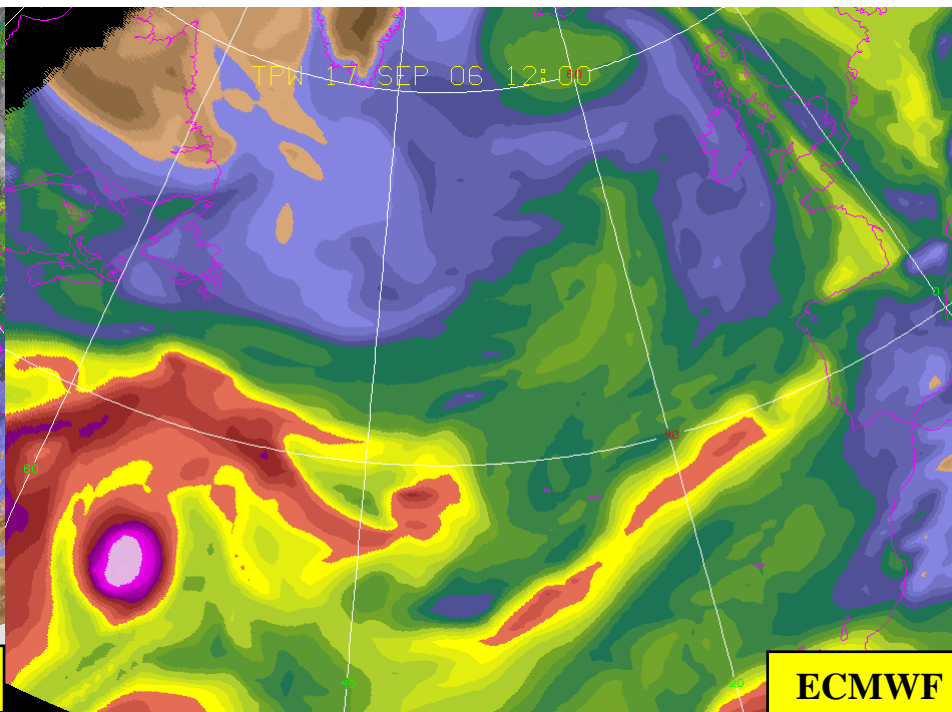
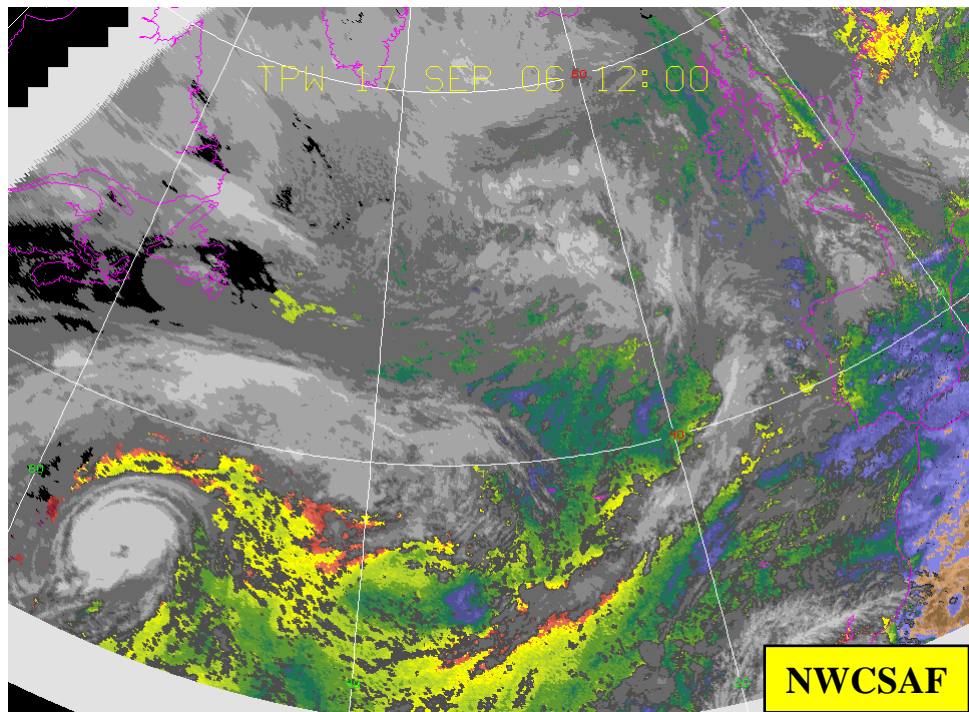
SAI\_LI



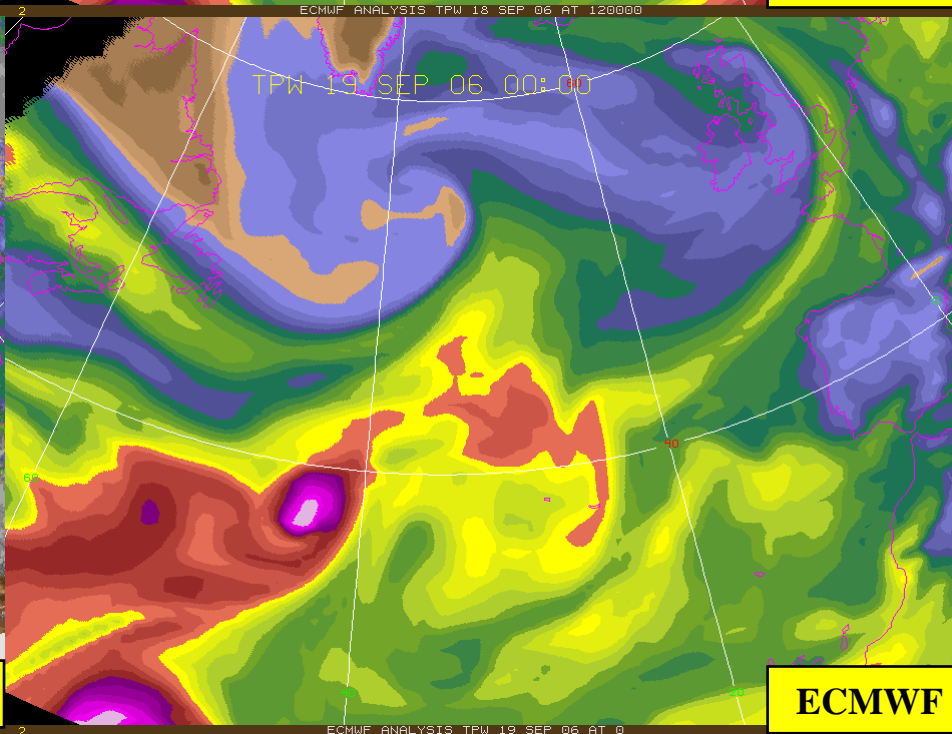
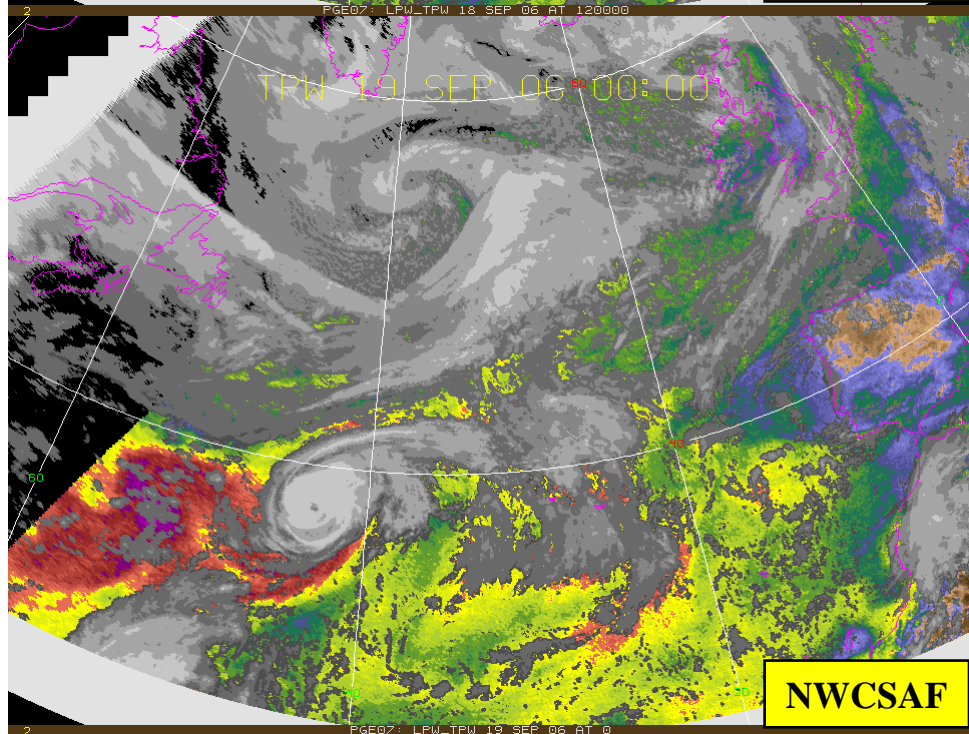
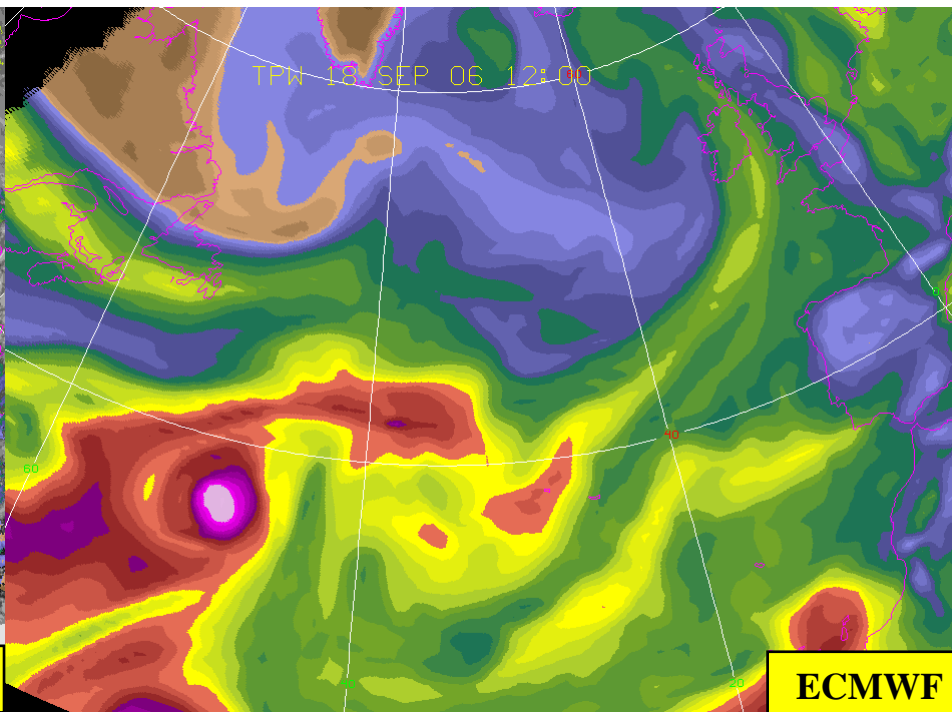
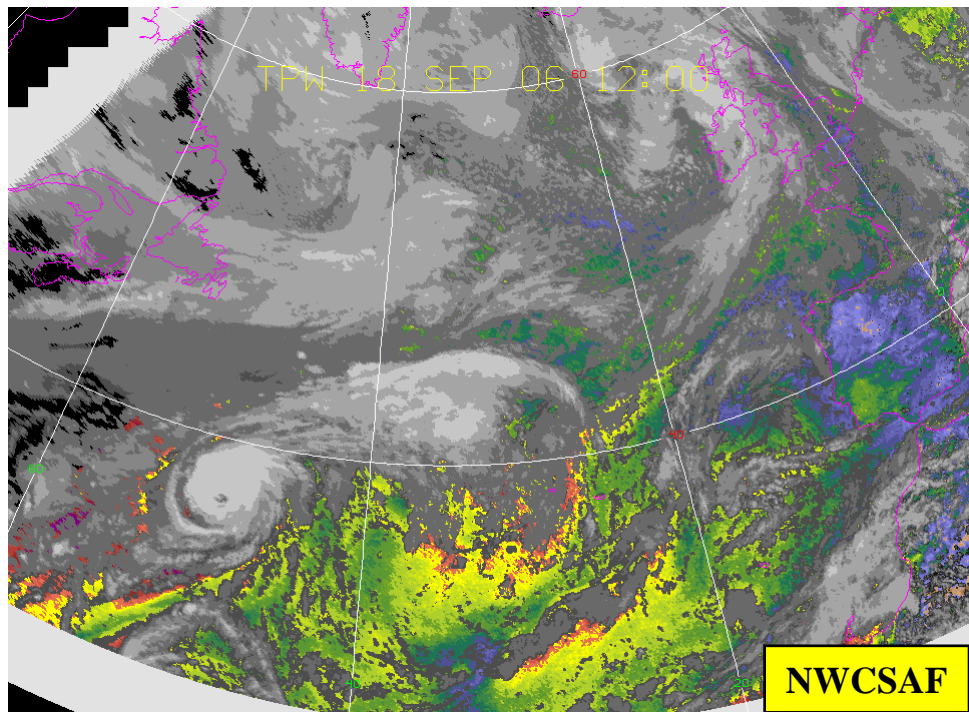
# GORDON Hurricane comparison NWCSAF/MSG TPW images VS ECMWF TPW



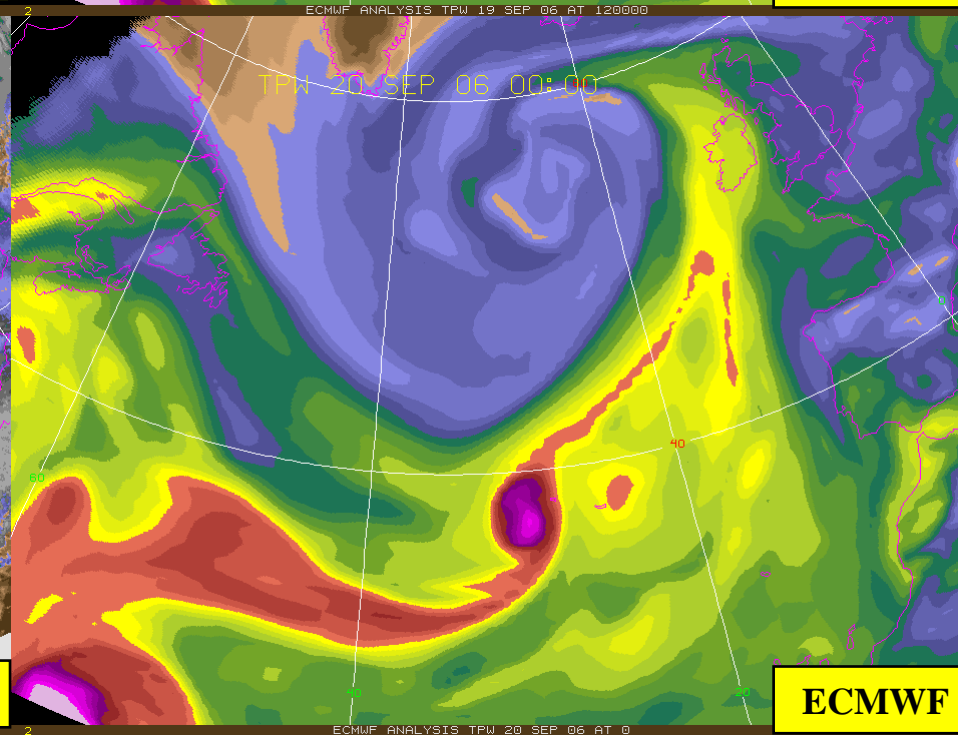
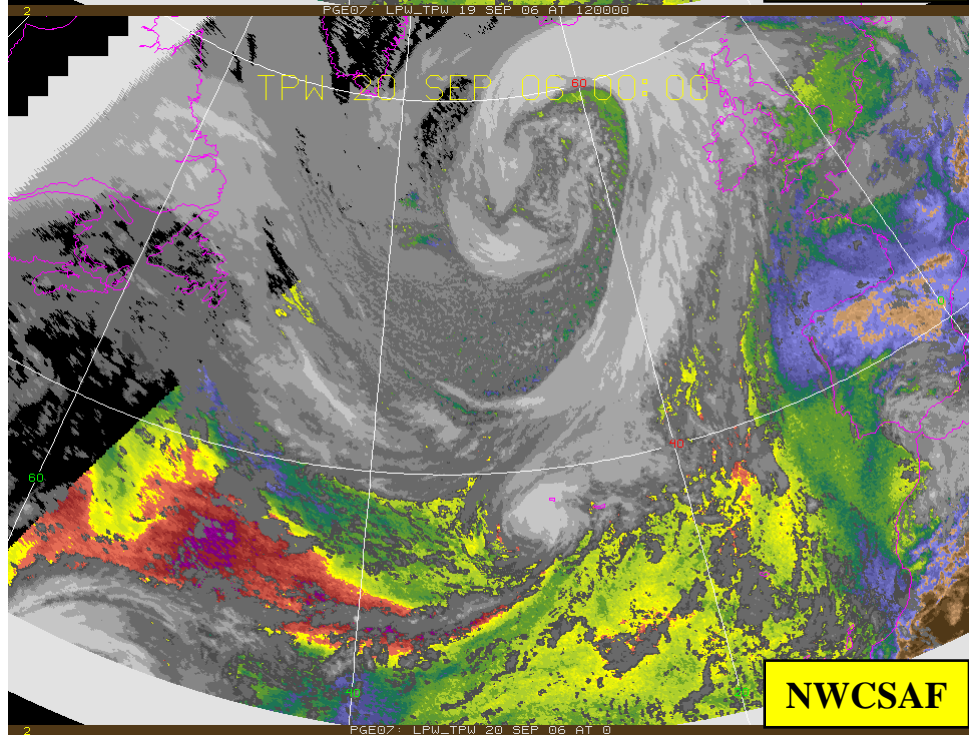
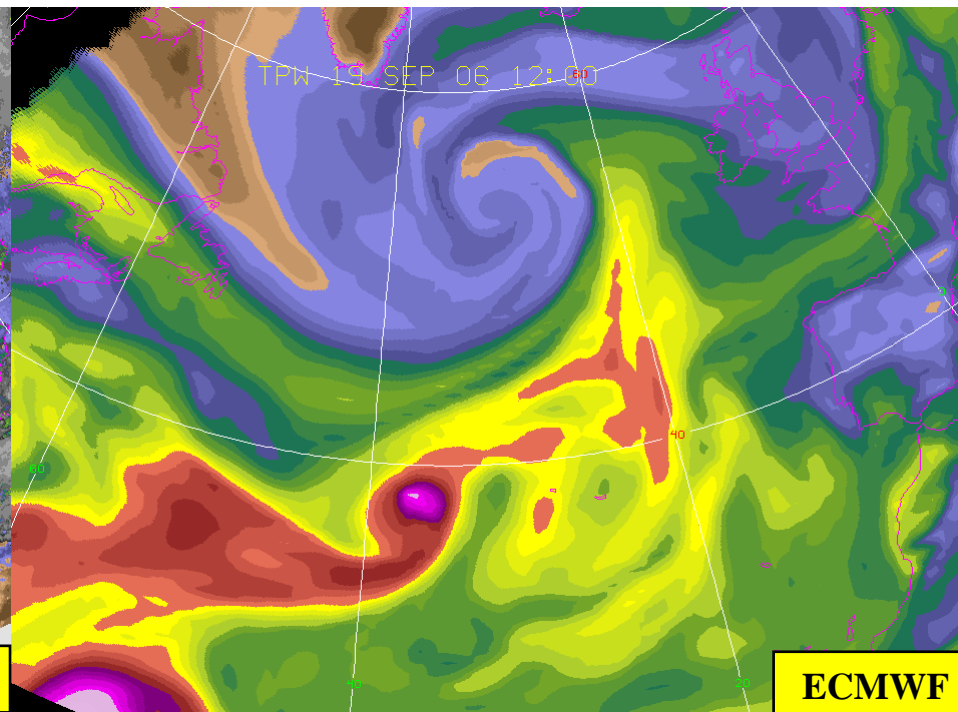
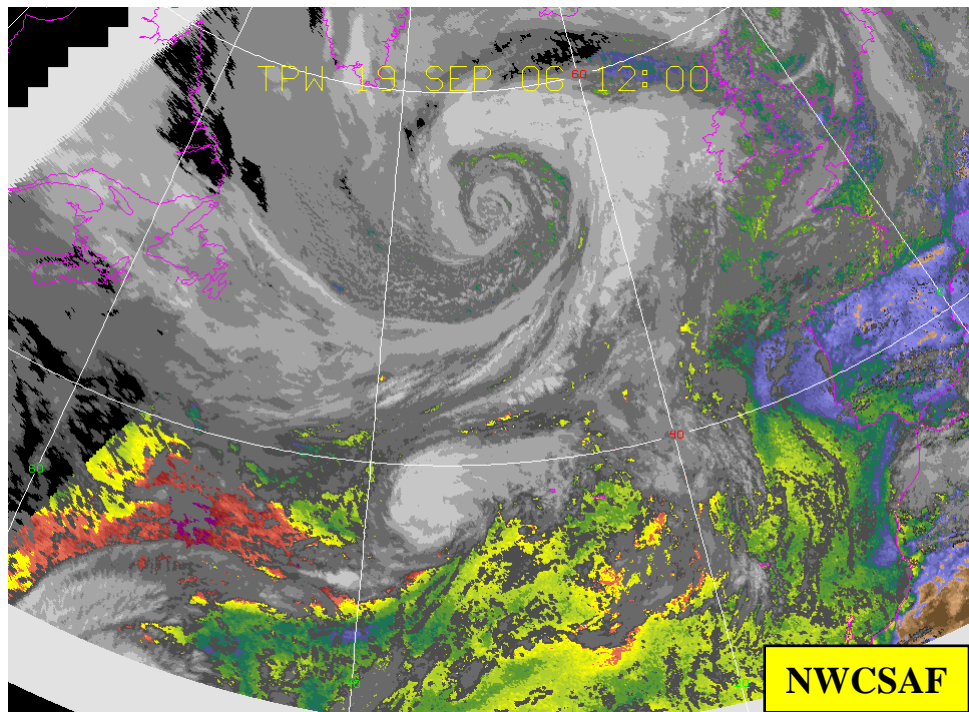




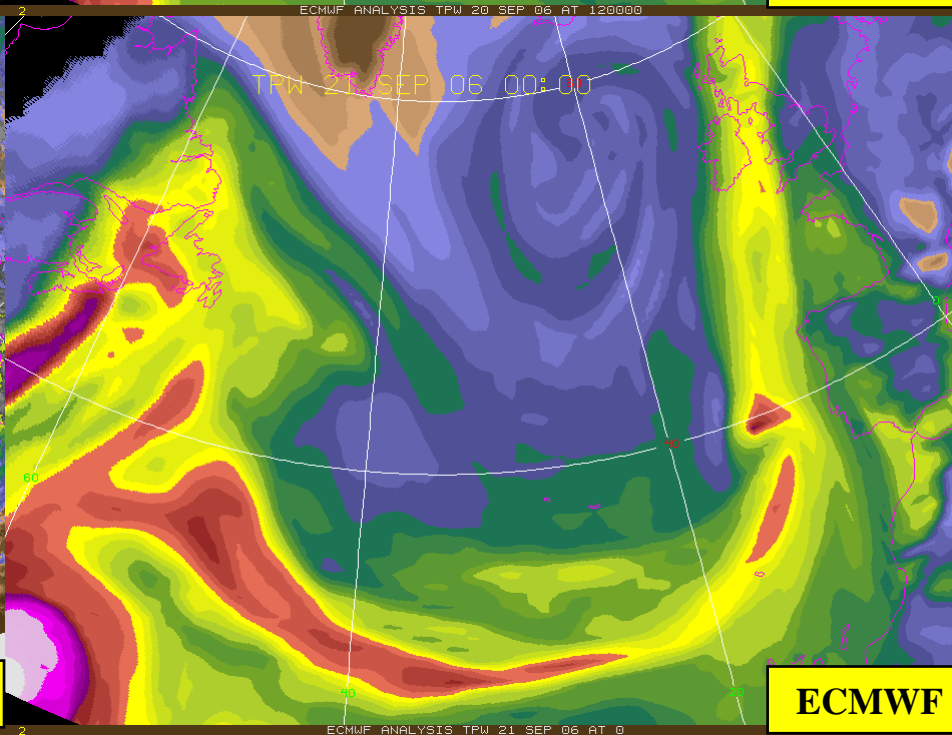
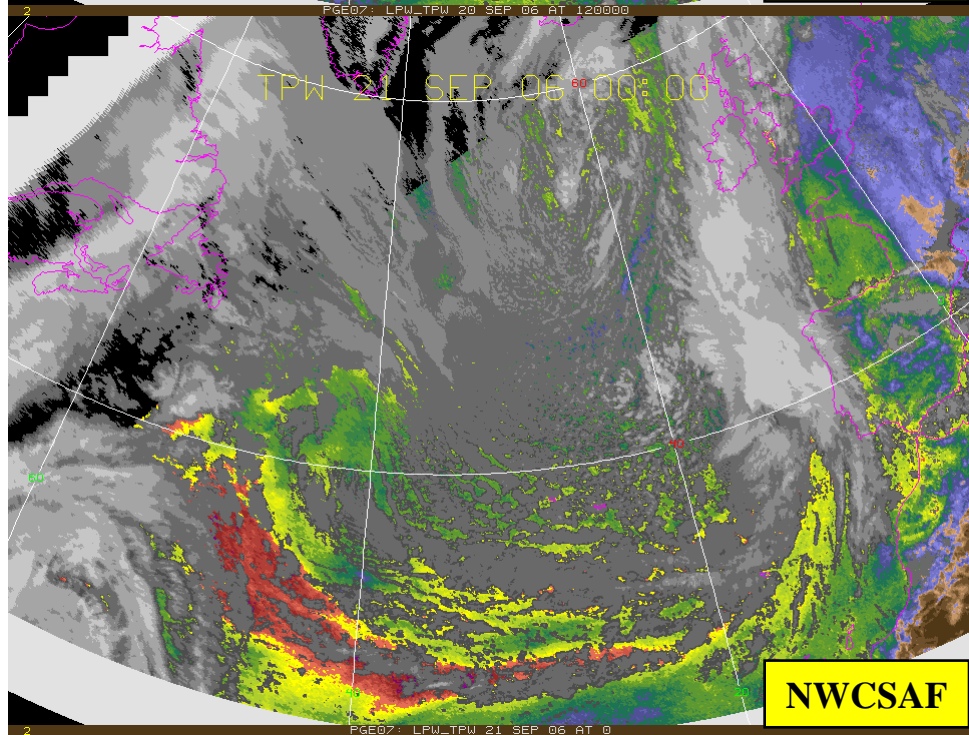
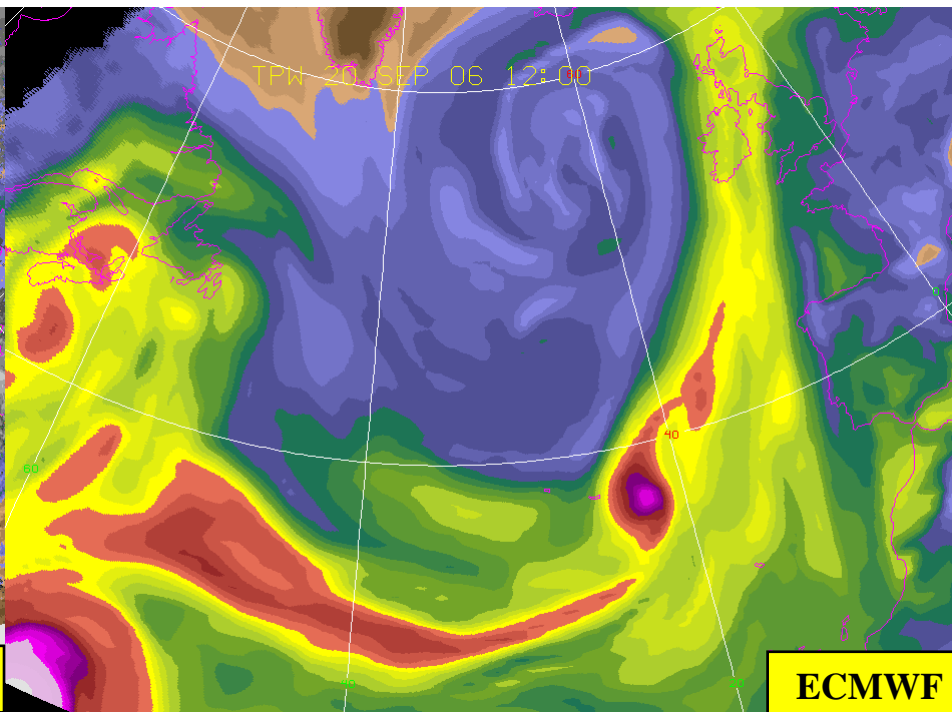
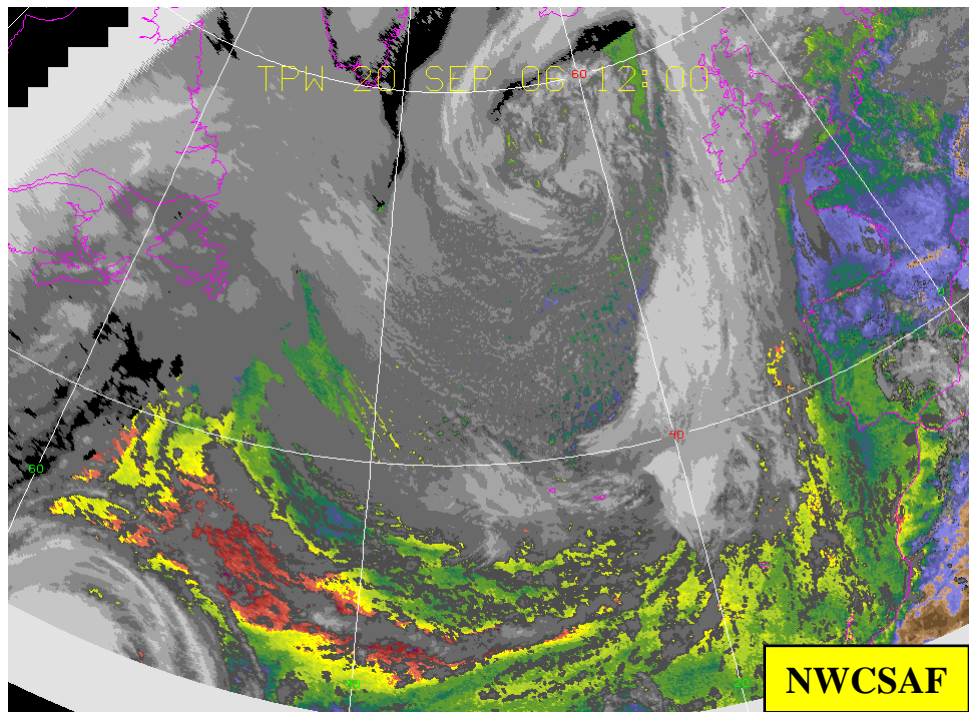






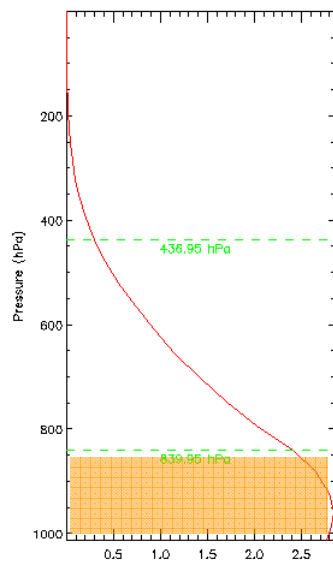




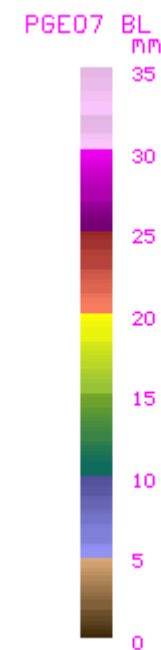


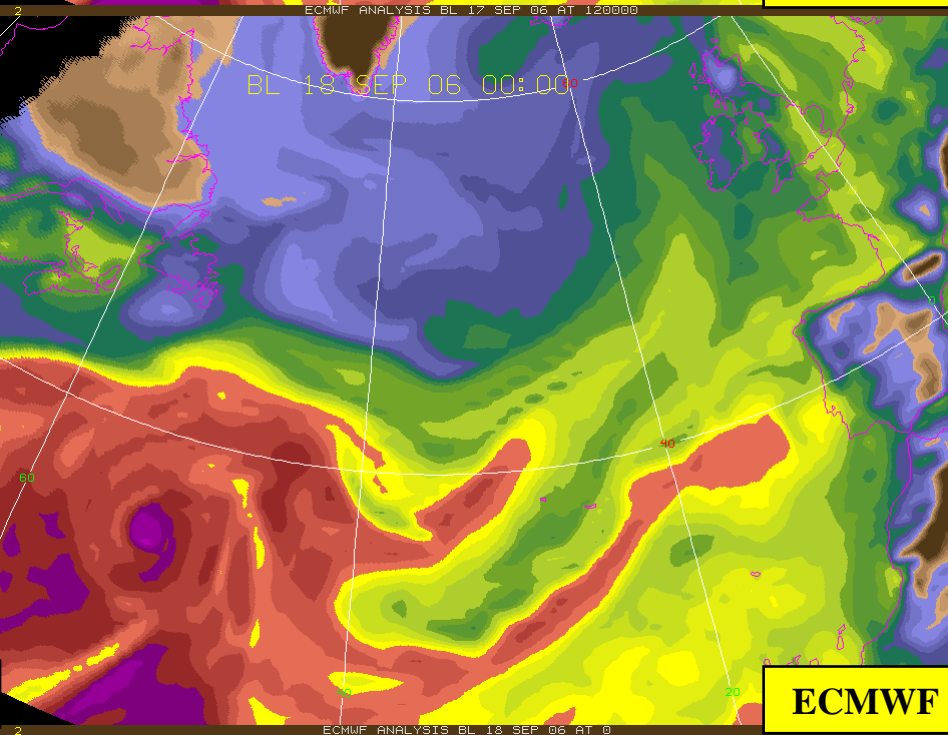
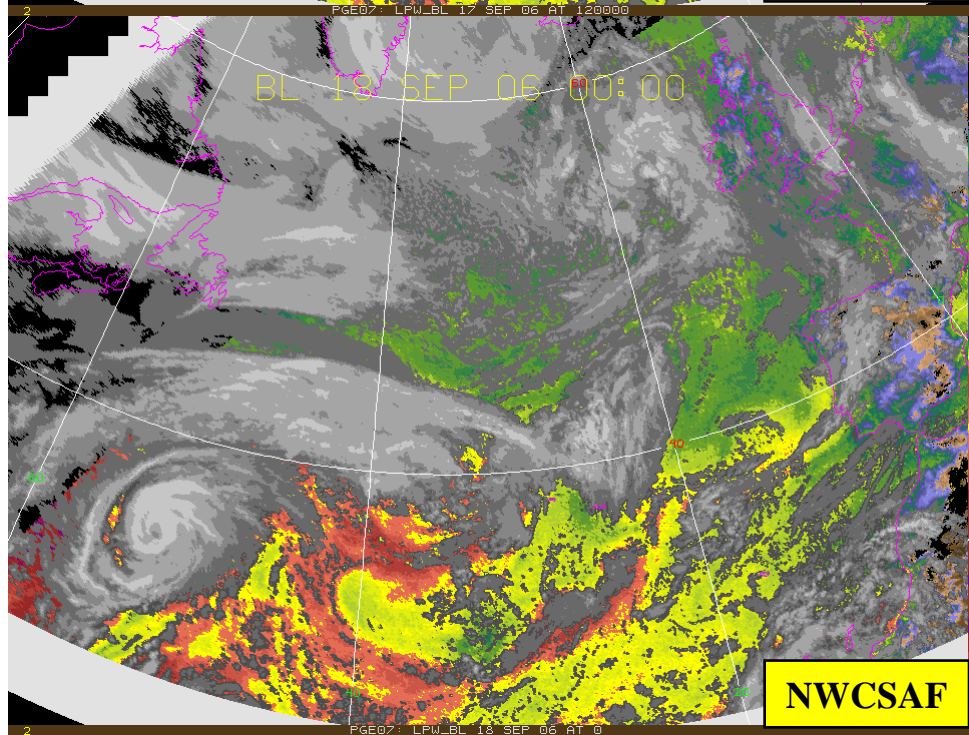
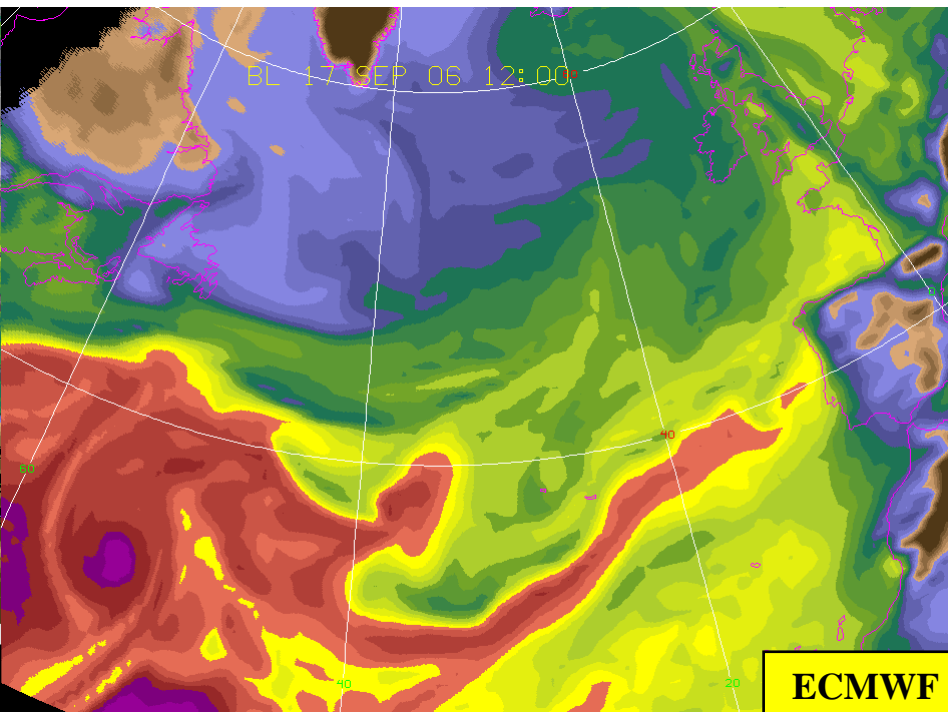
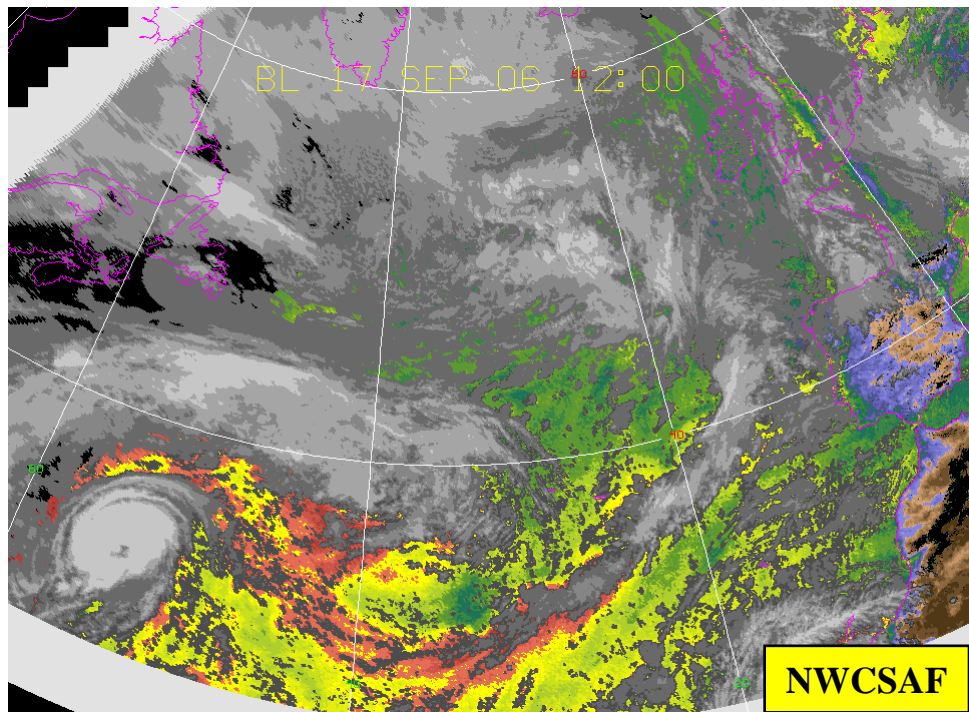


# GORDON Hurricane comparison NWCSAF/MSG BL images VS ECMWF BL

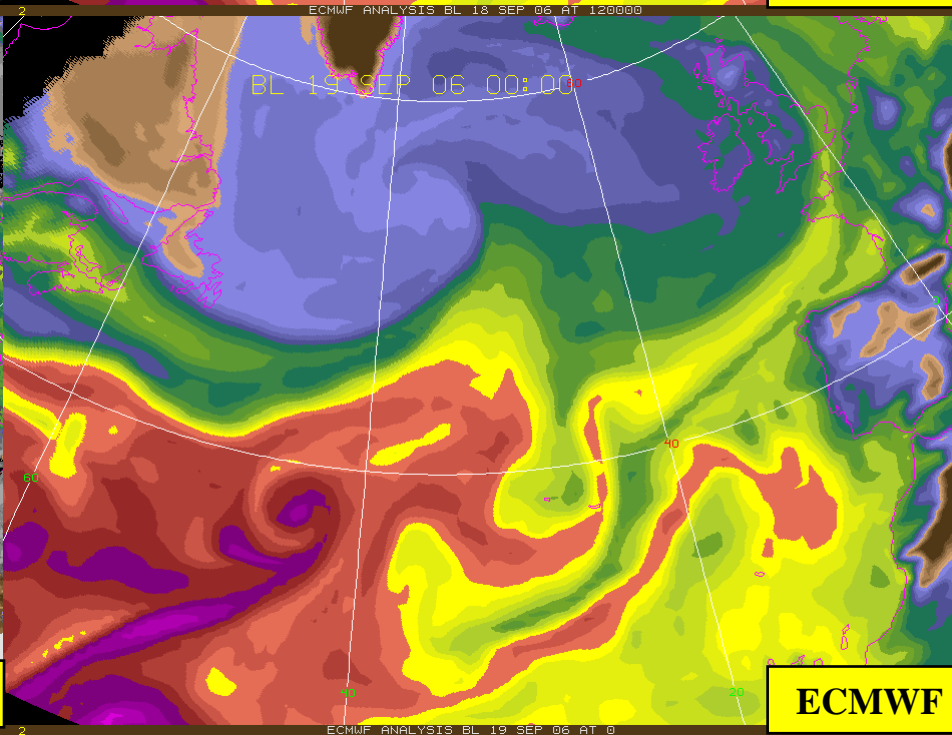
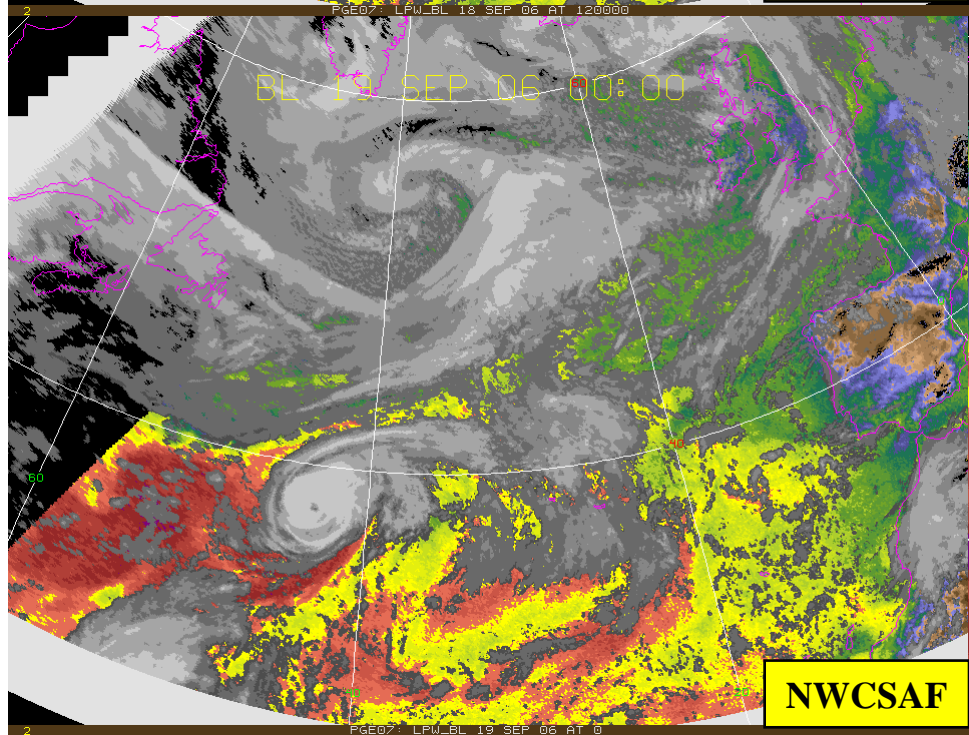
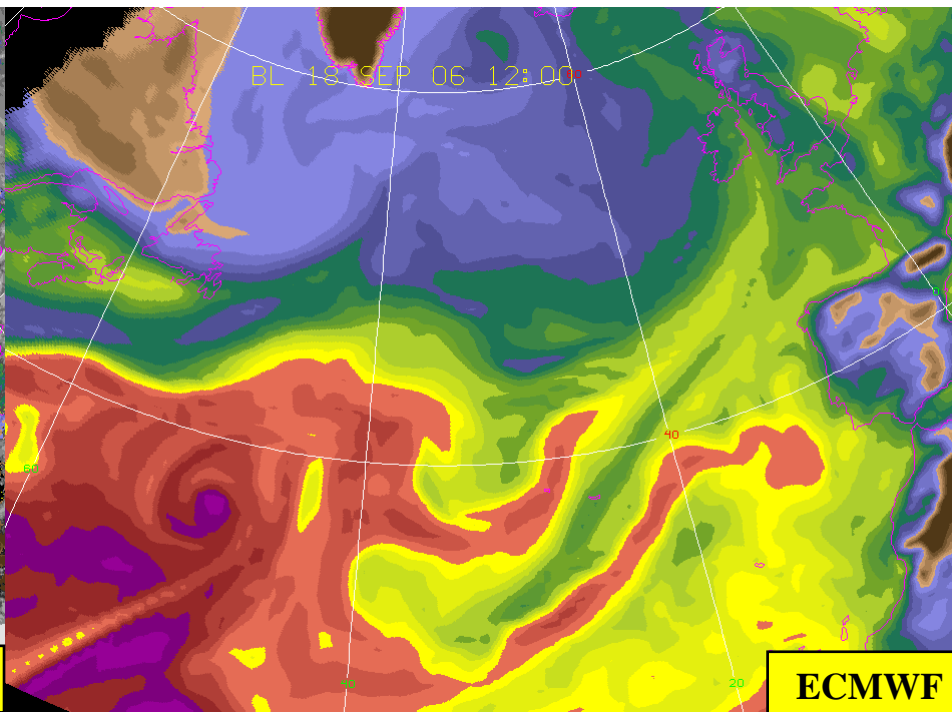
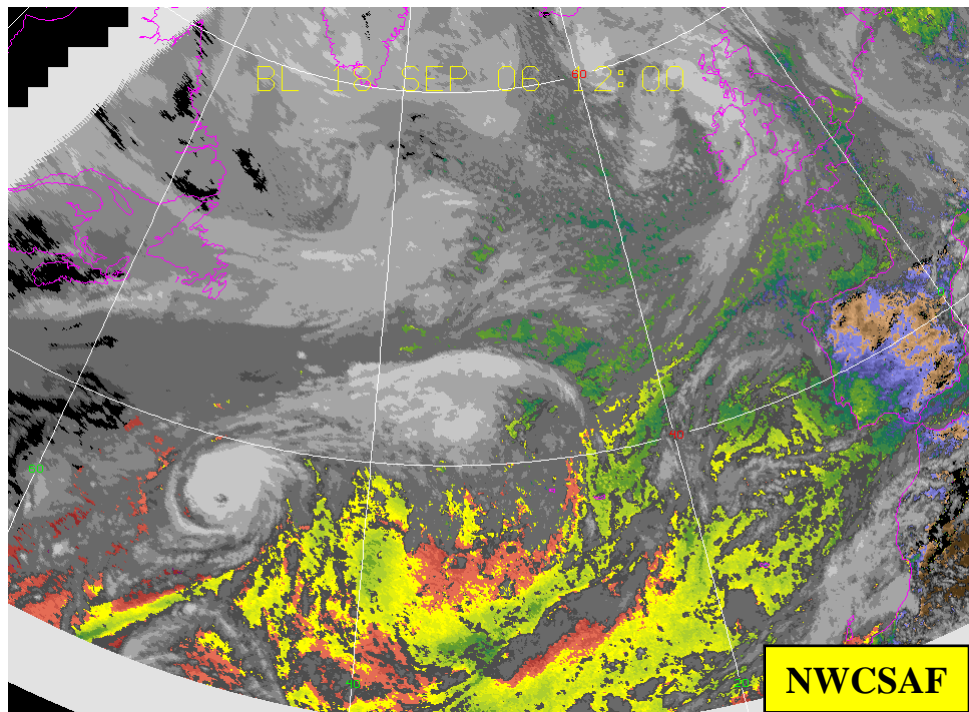


Boundary Layer (BL)  
(1013hPa-840 hPa)

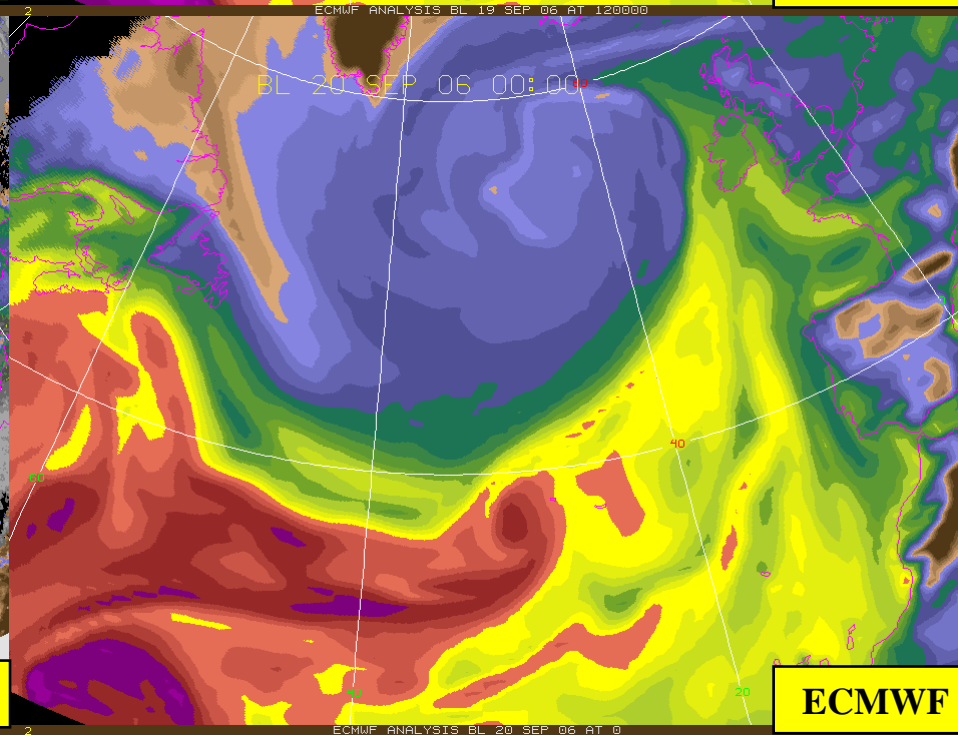
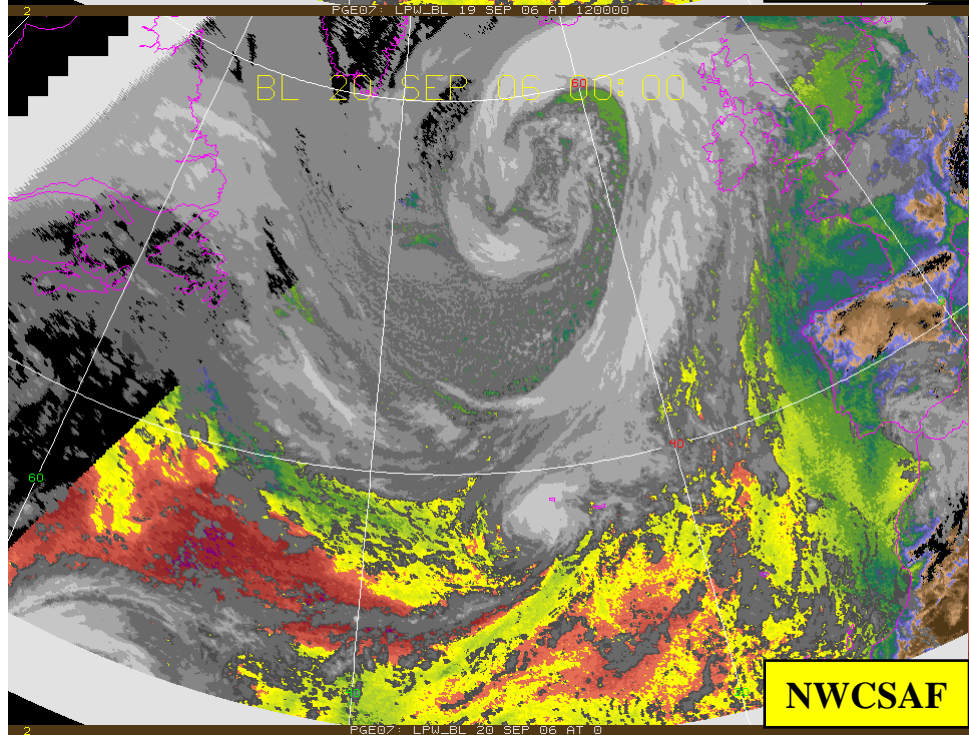
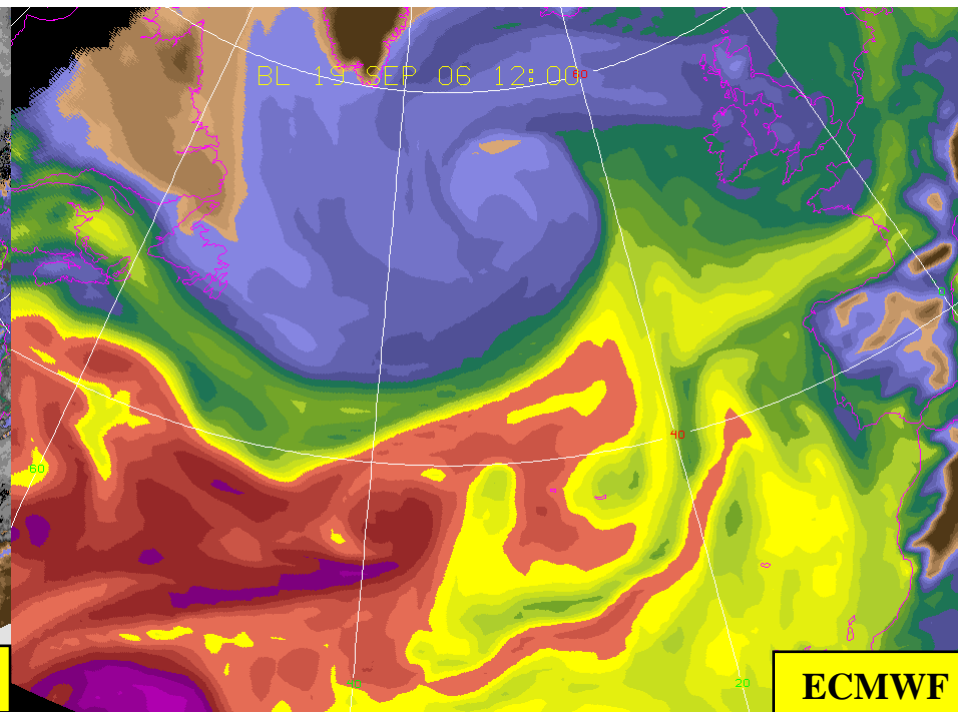
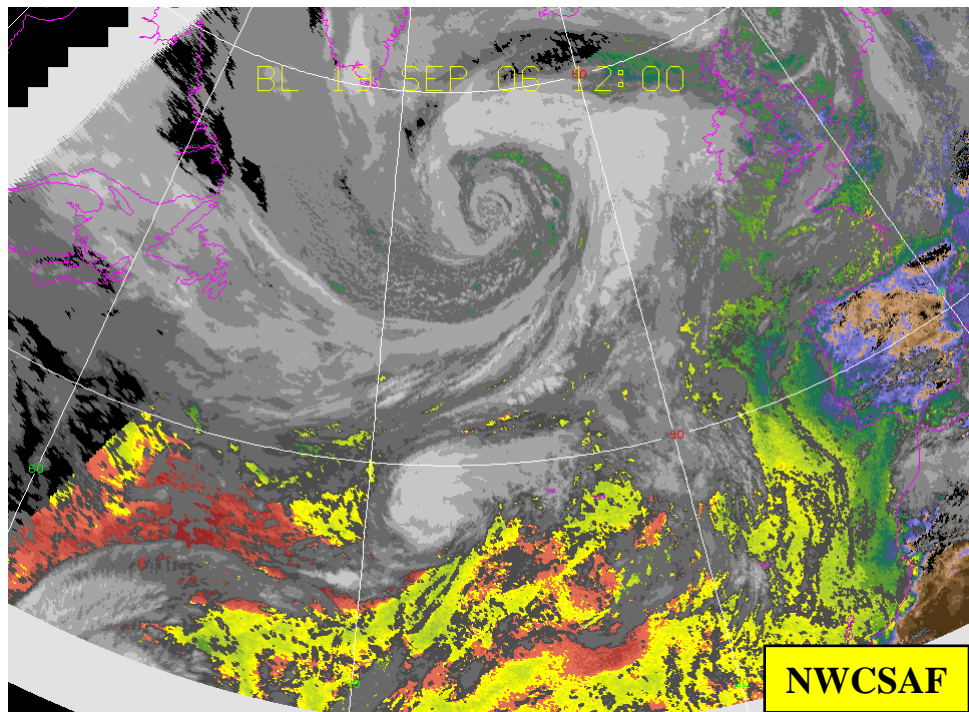




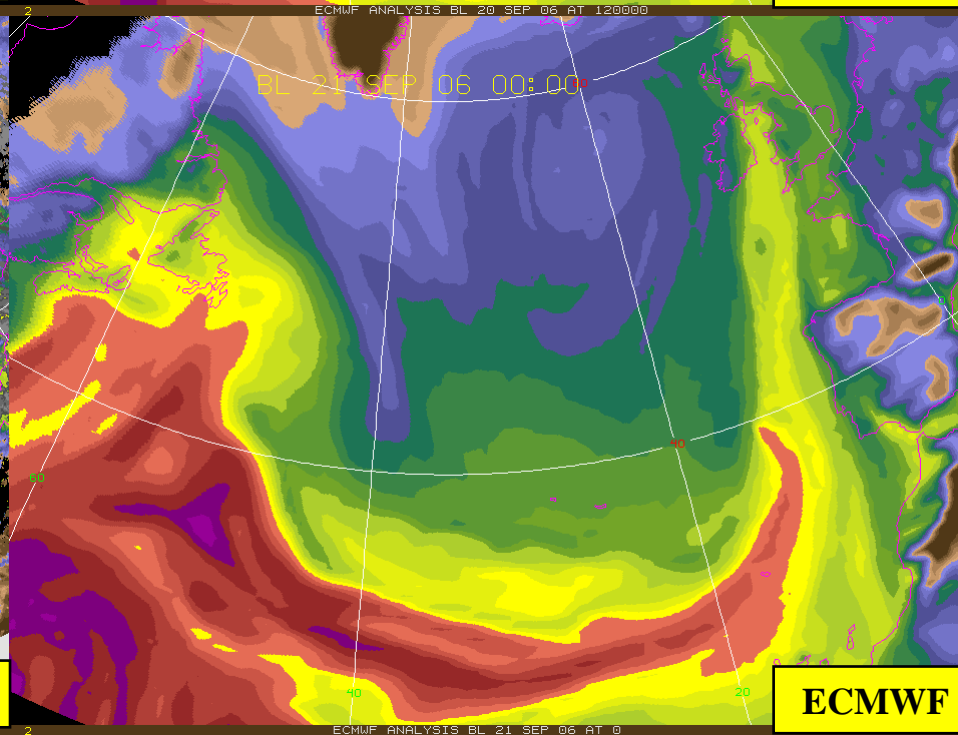
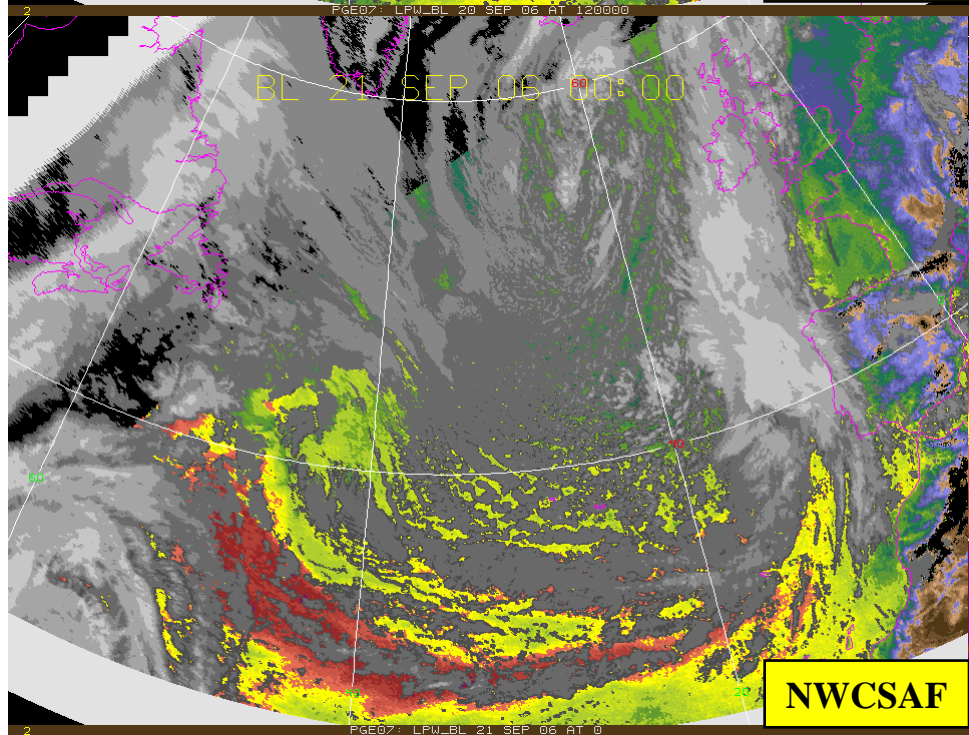
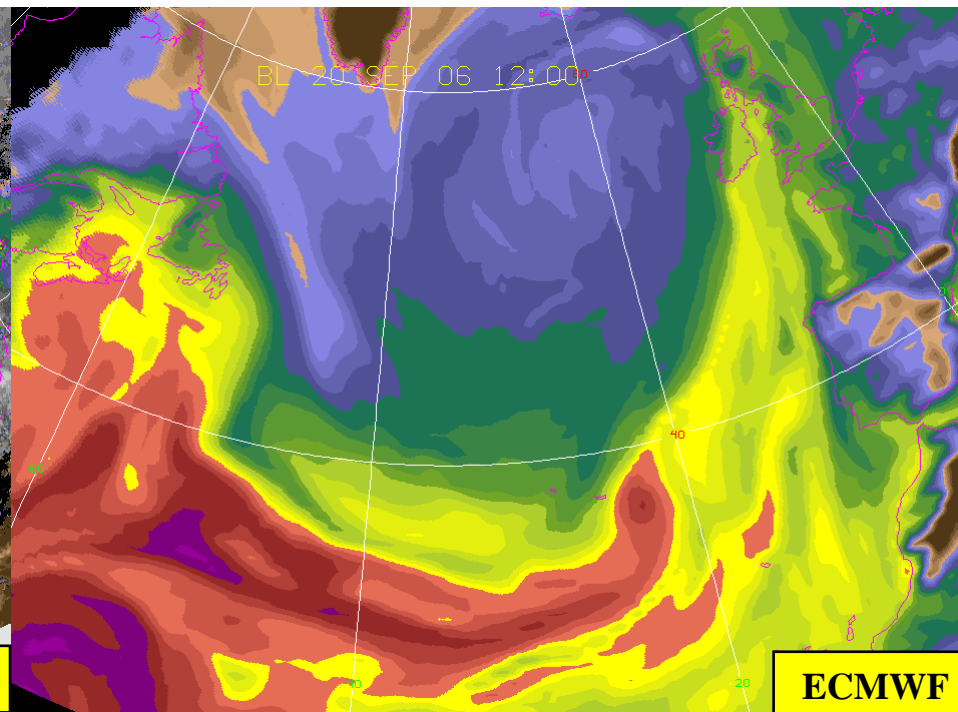
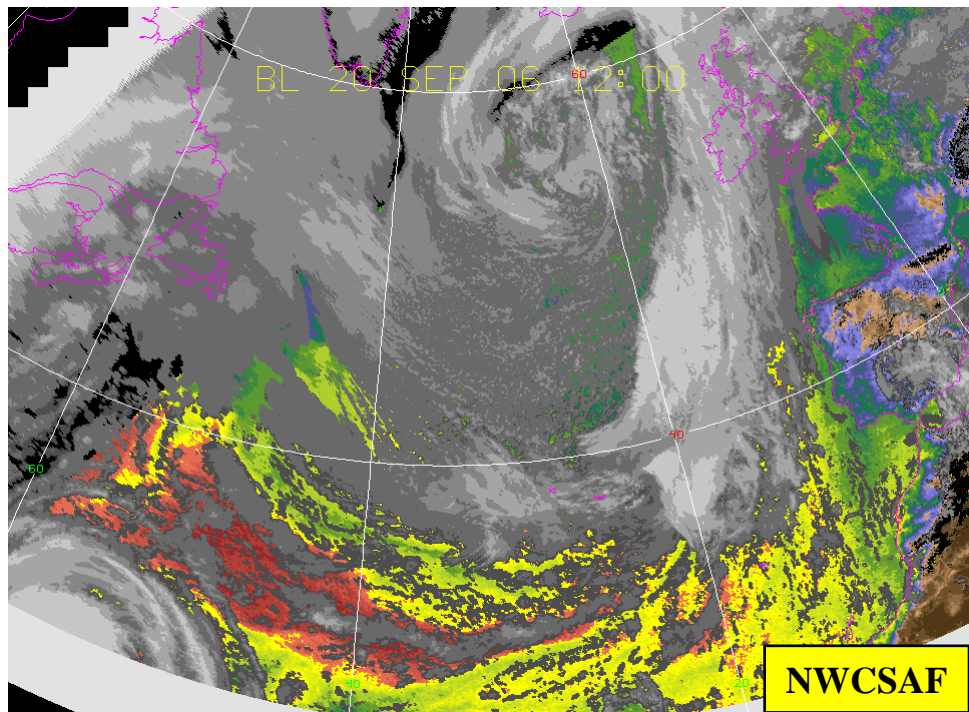






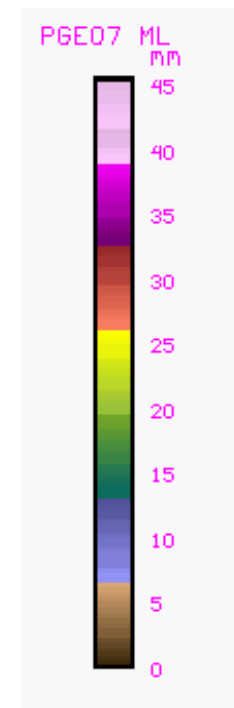
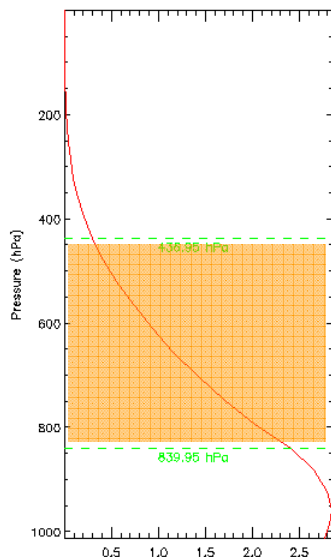


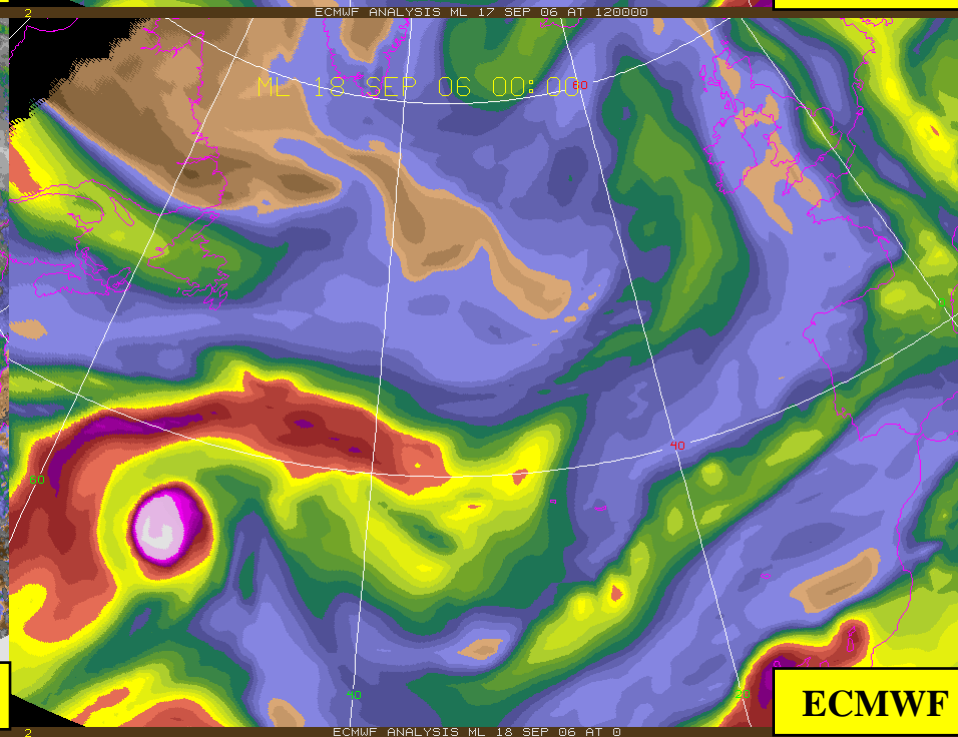
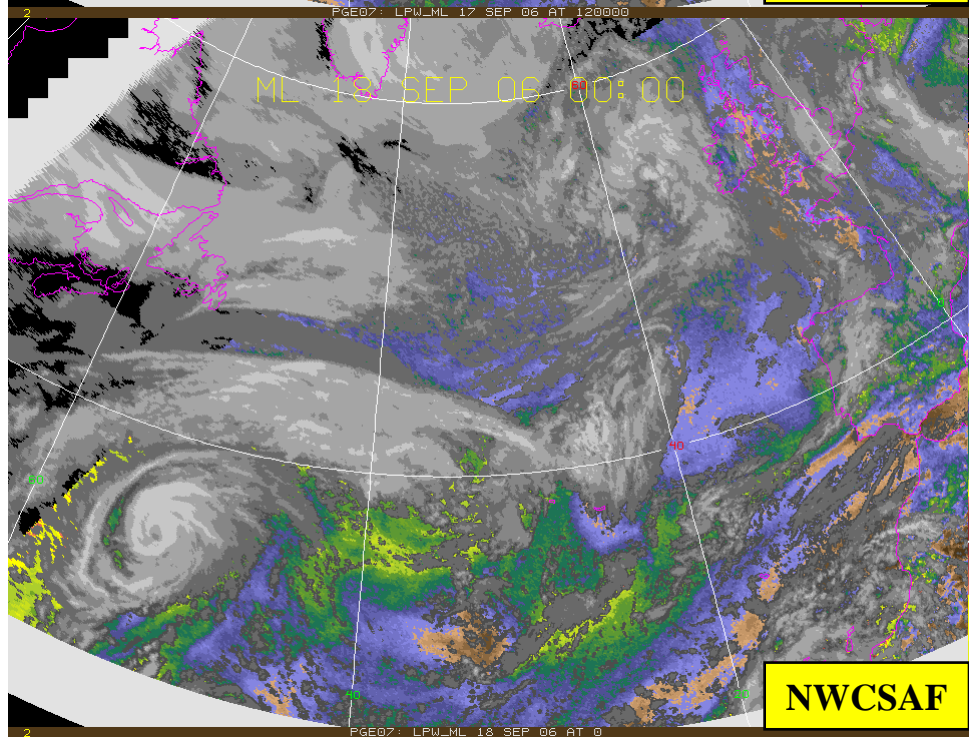
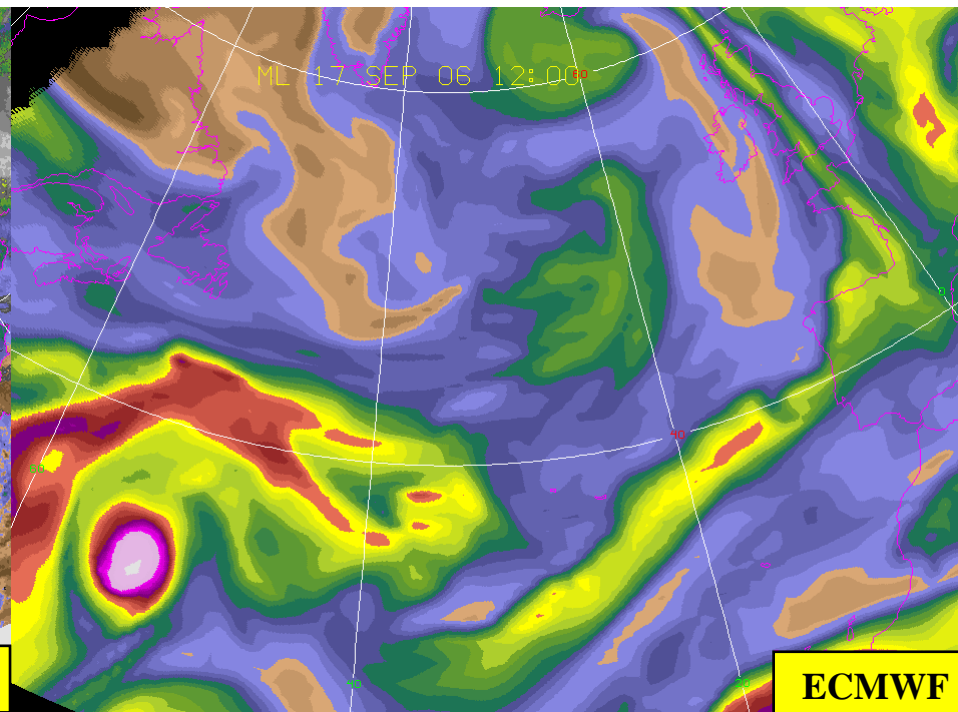
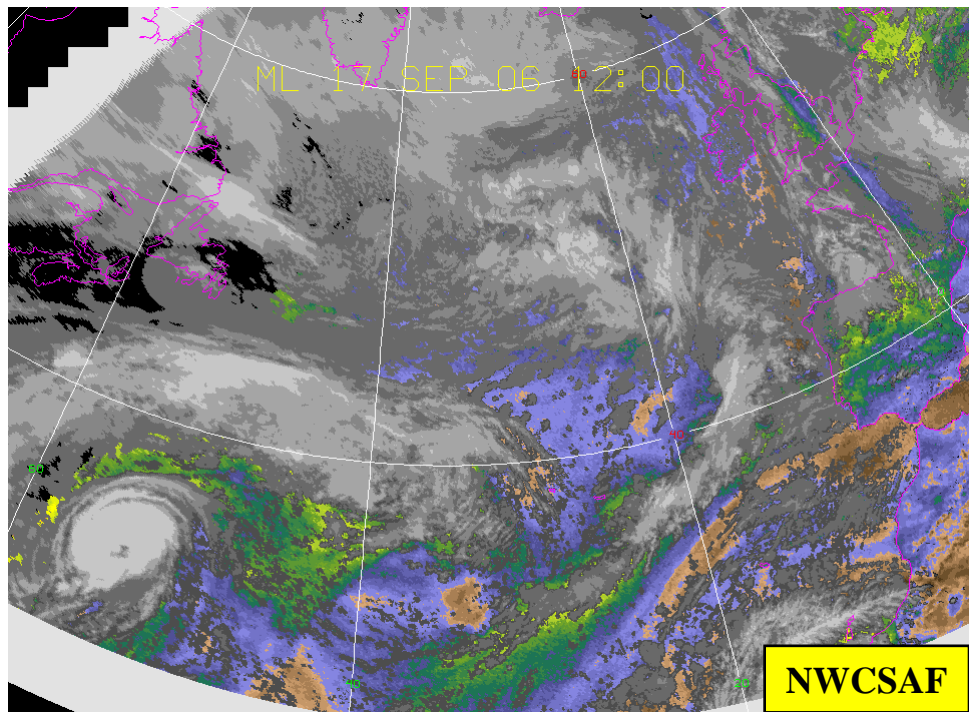




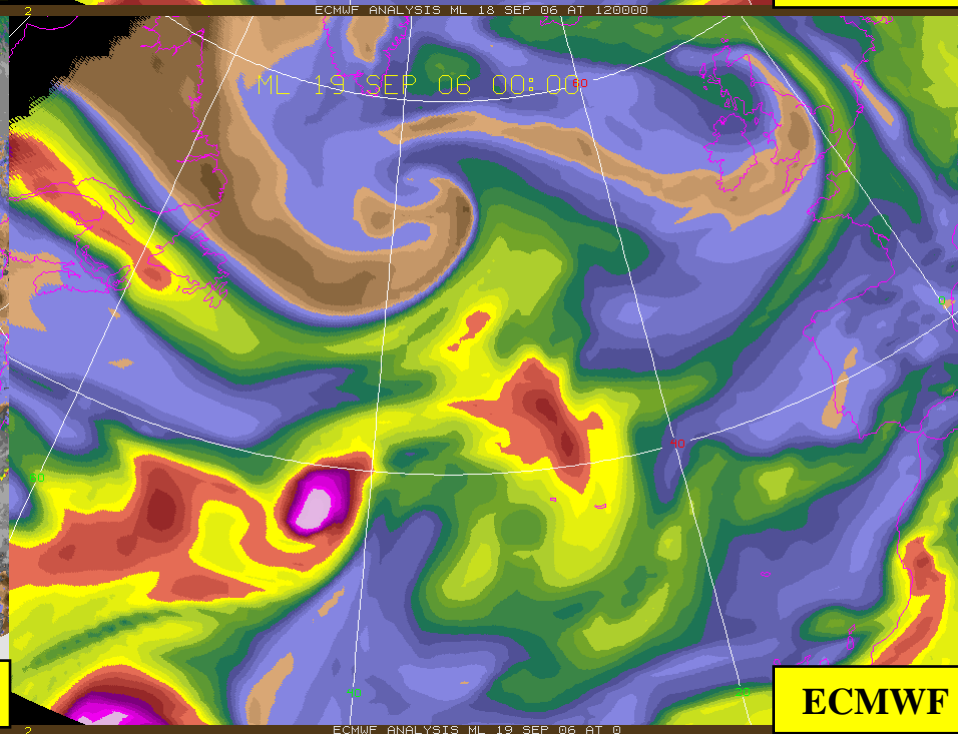
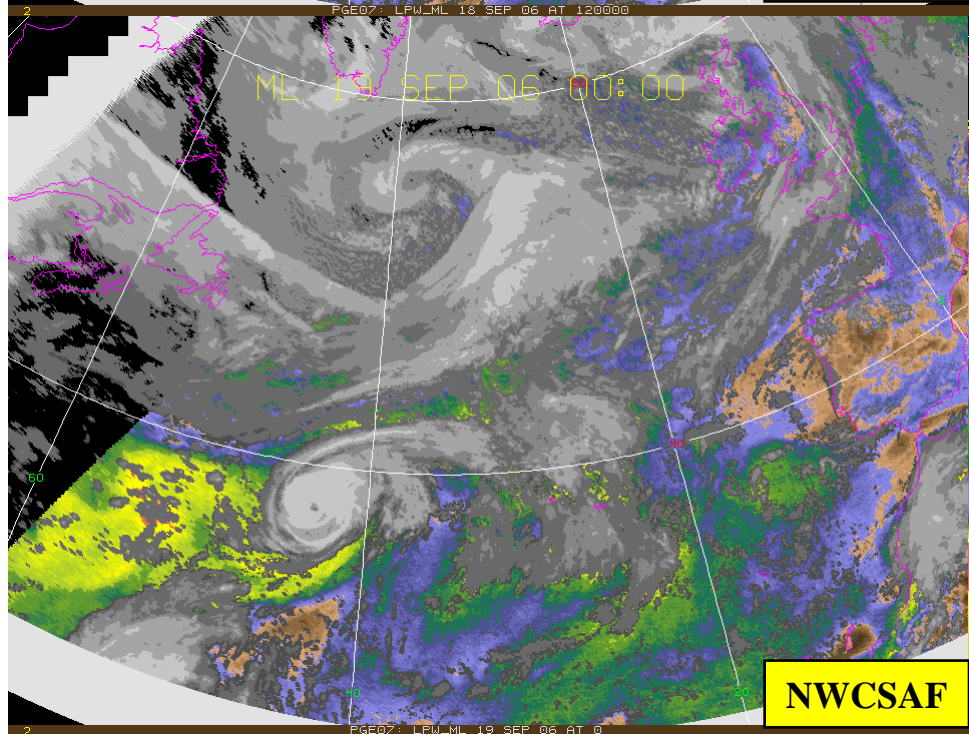
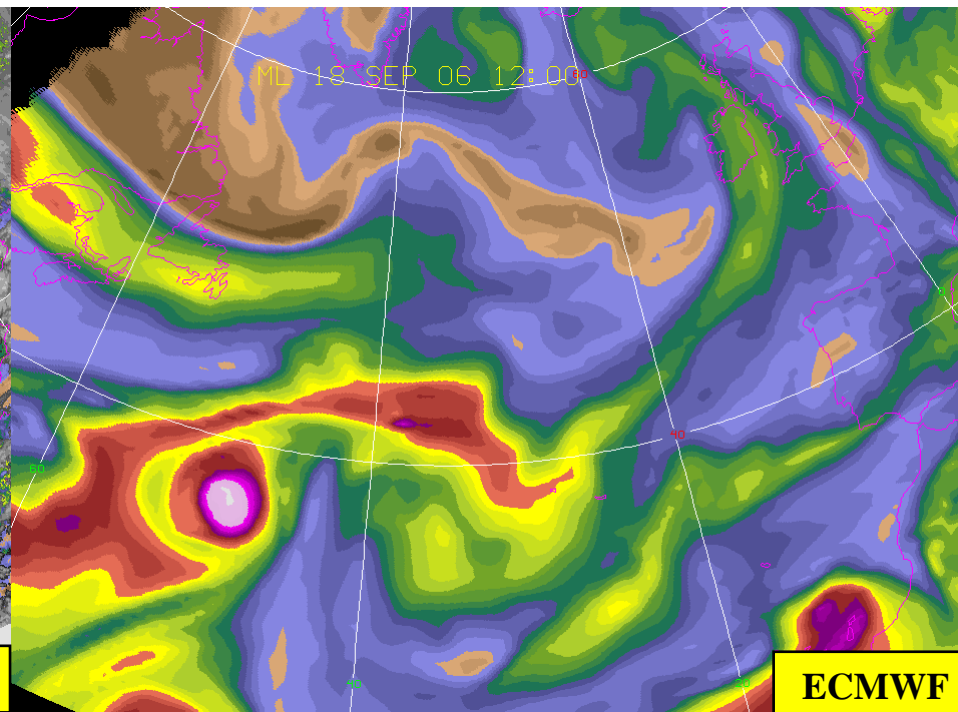
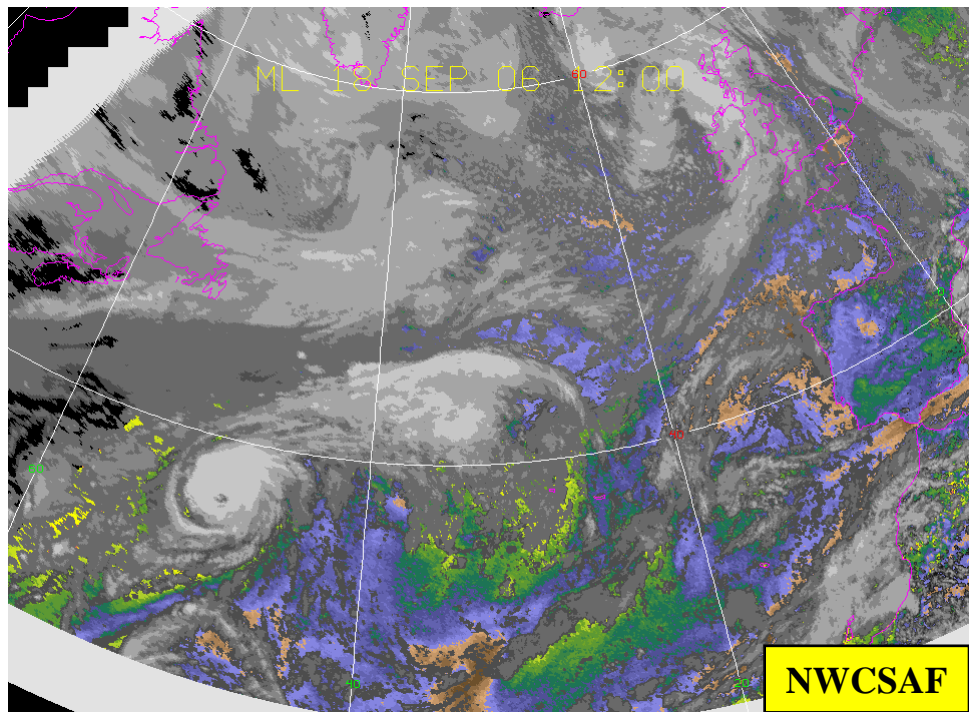


# GORDON Hurricane comparison NWCSAF/MSG ML images VS ECMWF ML Middle Layer (ML) (840hPa-437hPa)

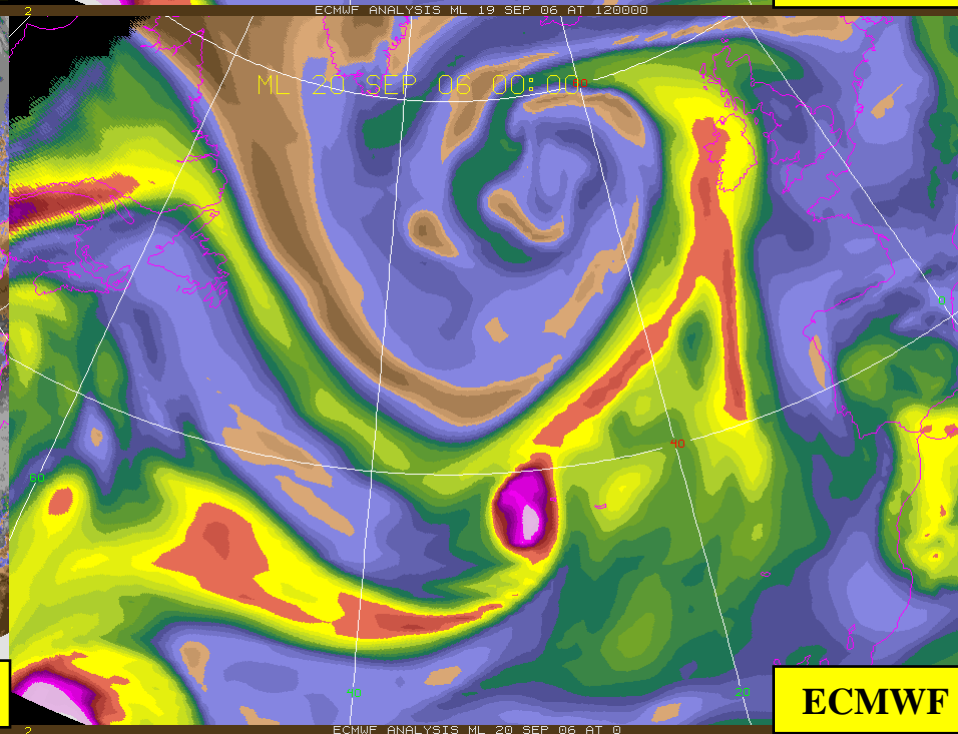
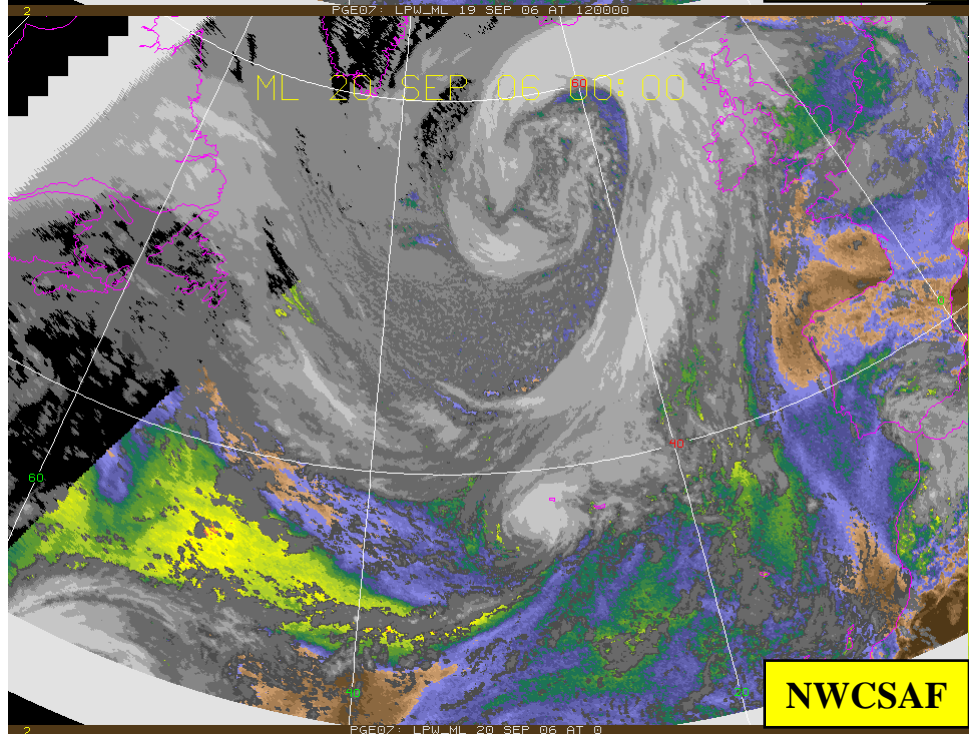
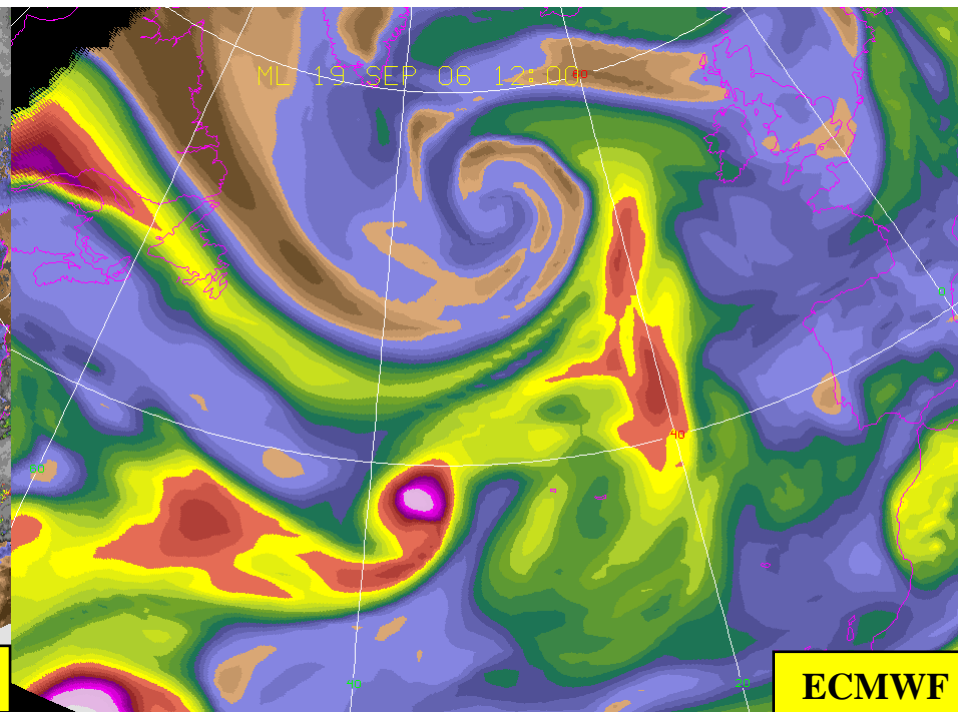
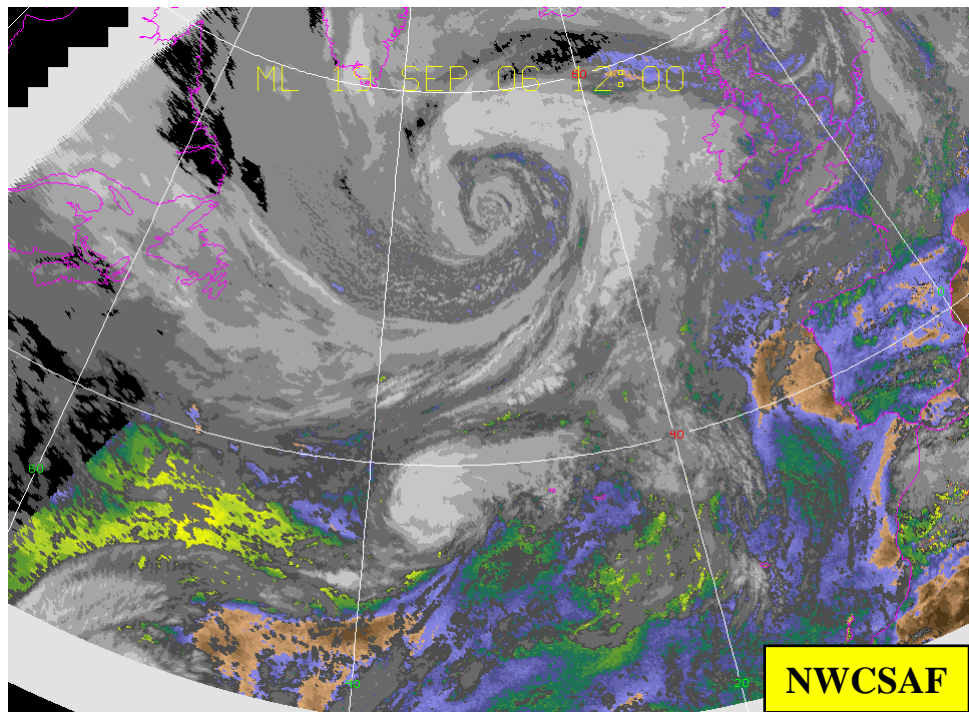




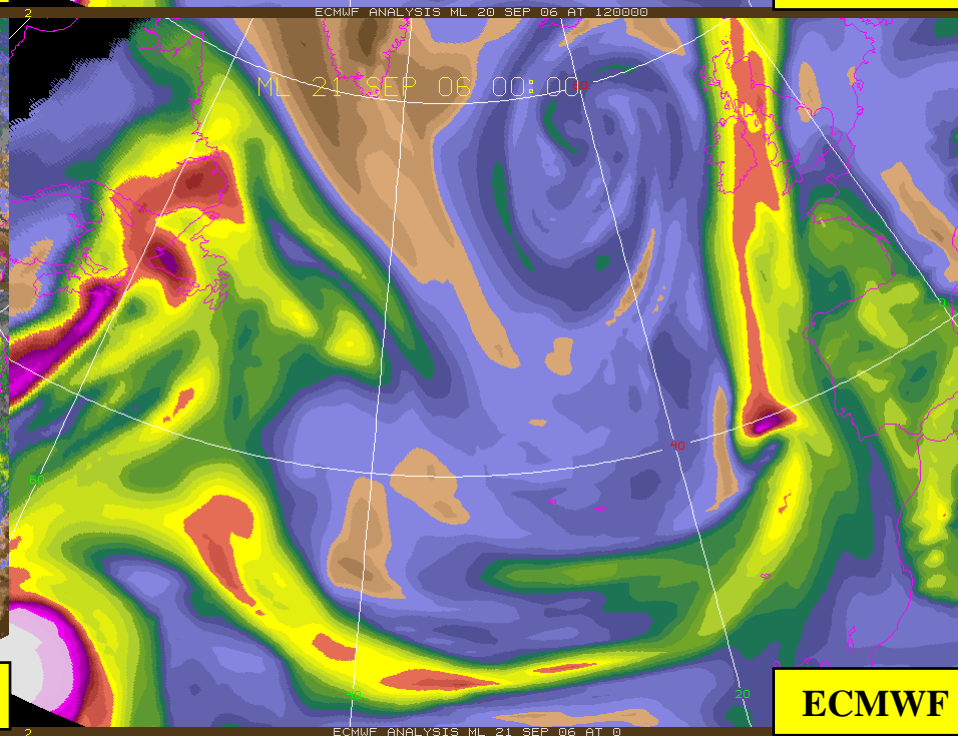
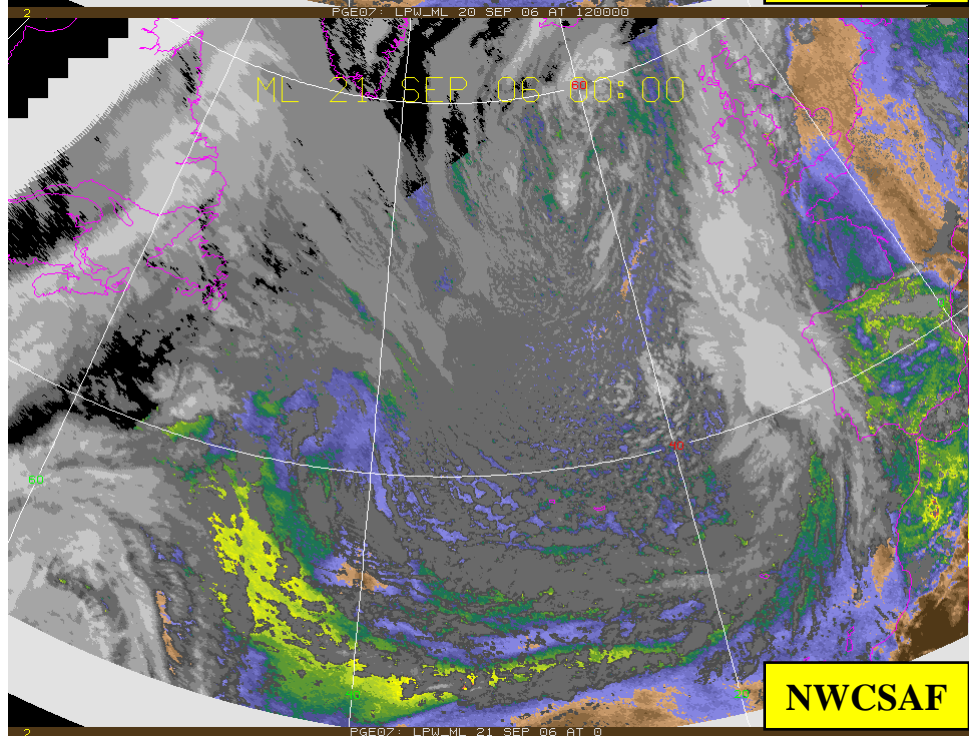
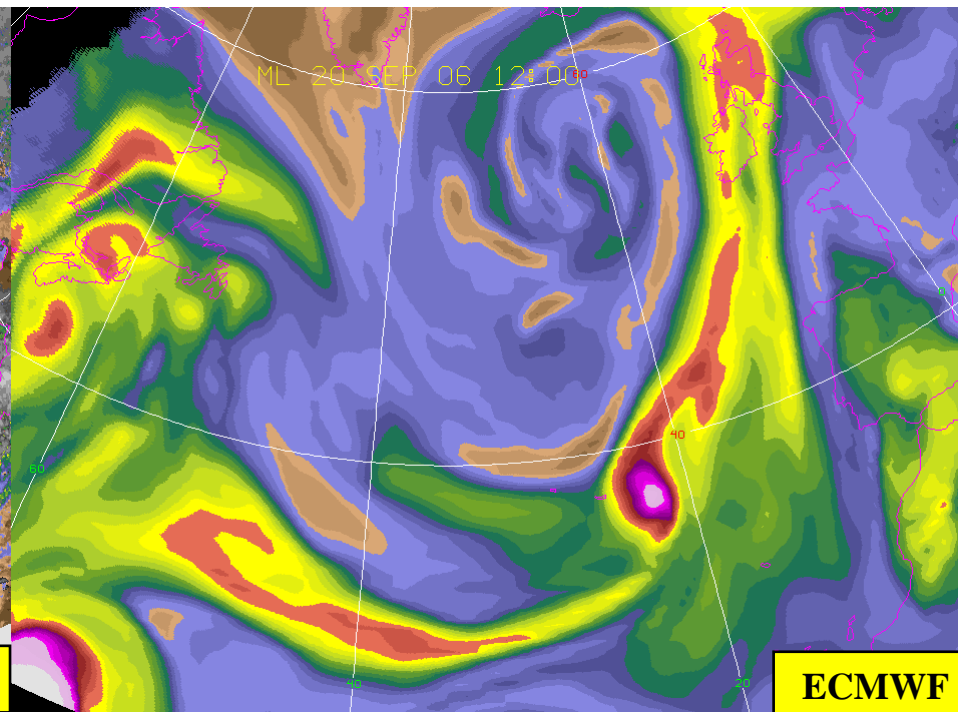
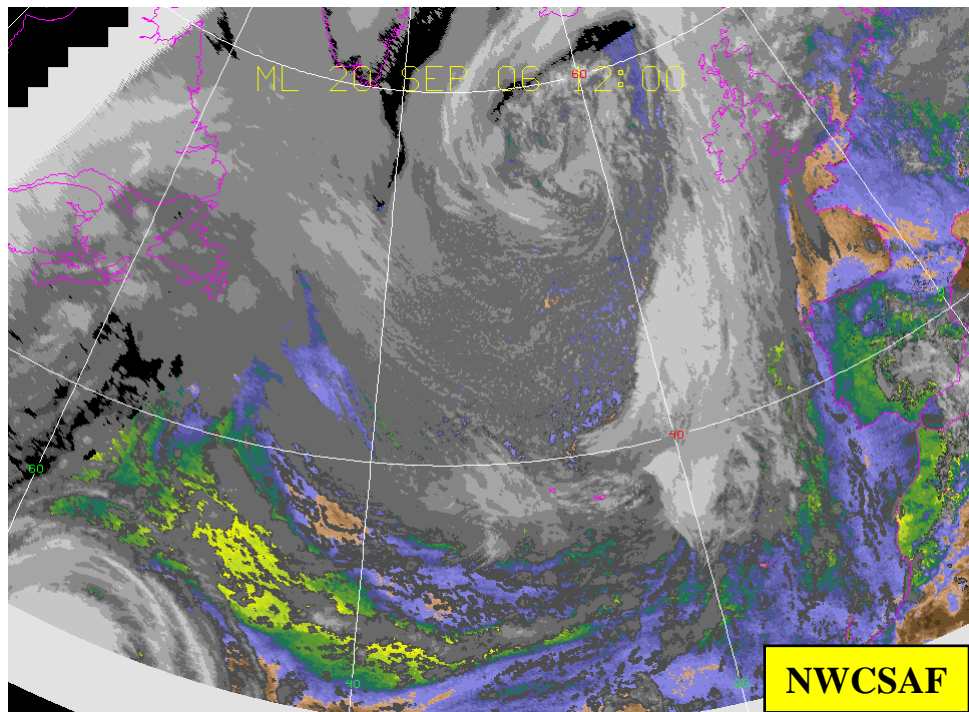










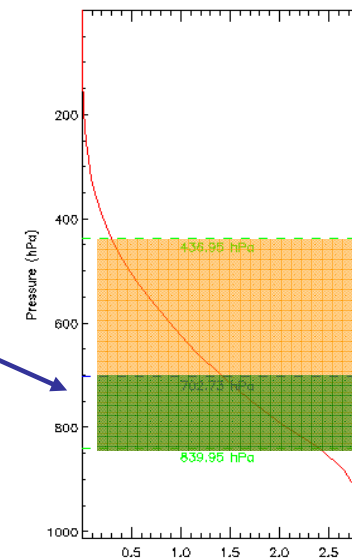


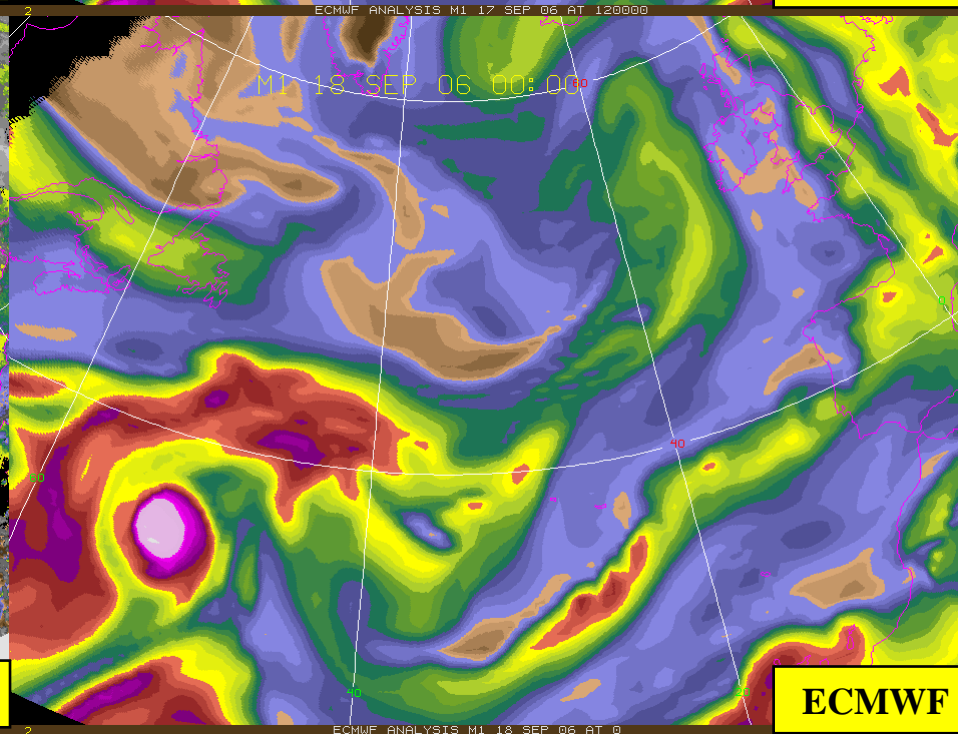
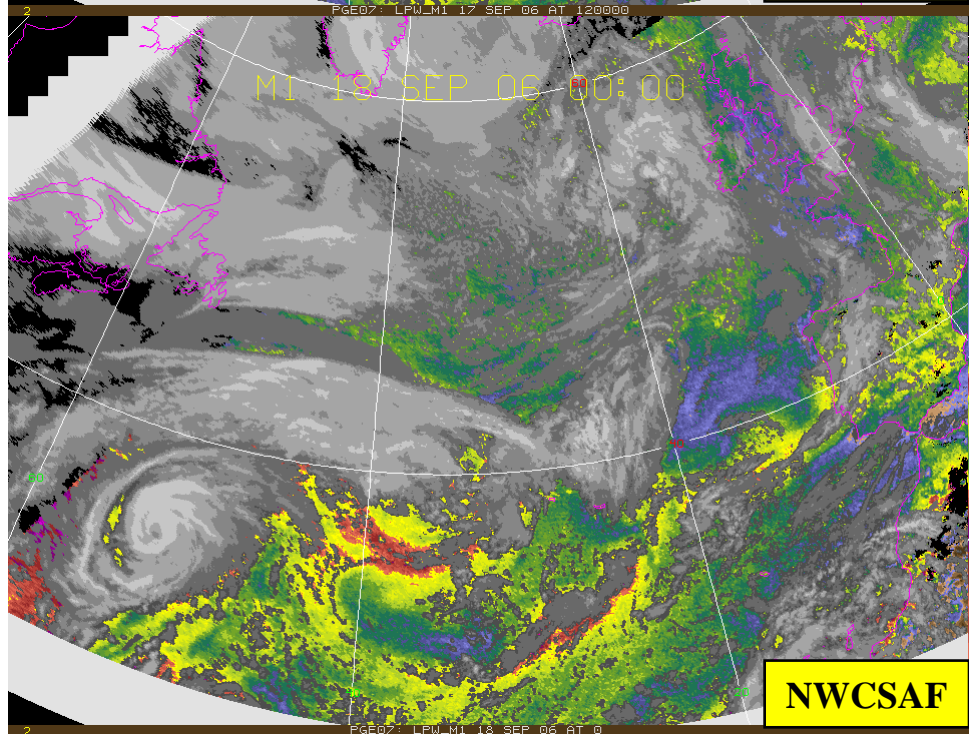
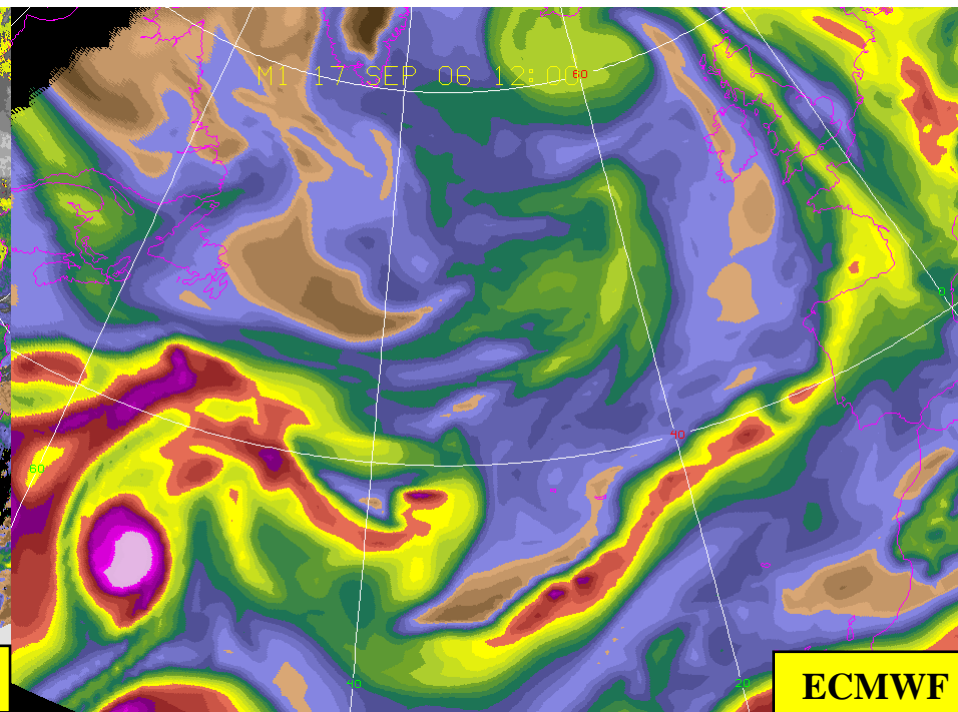
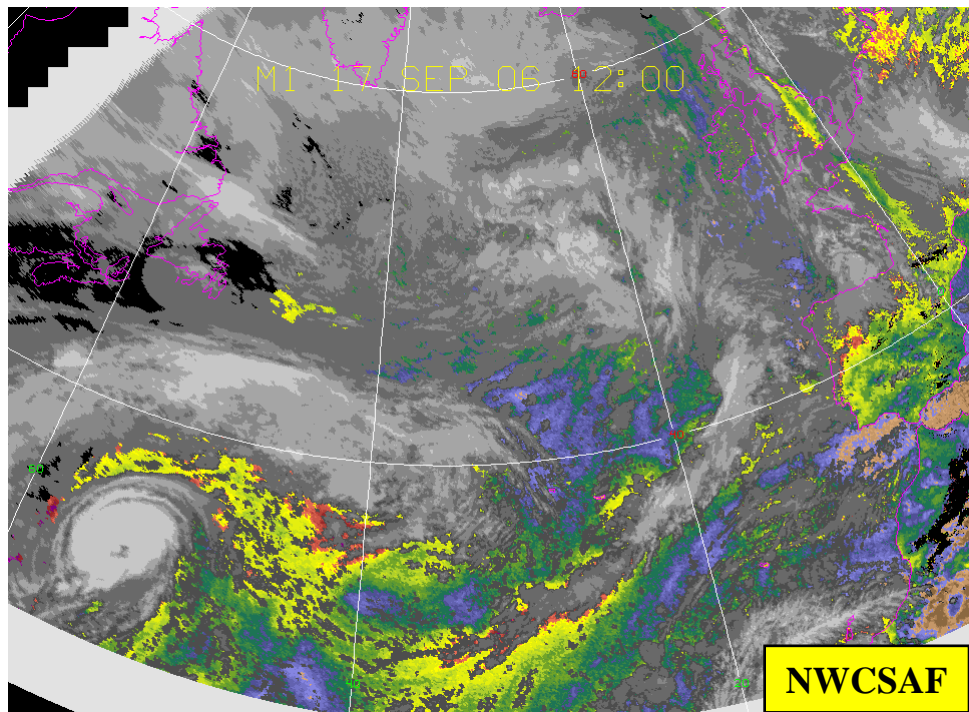


# GORDON Hurricane comparison NWCSAF/MSG M1 images VS ECMWF M1

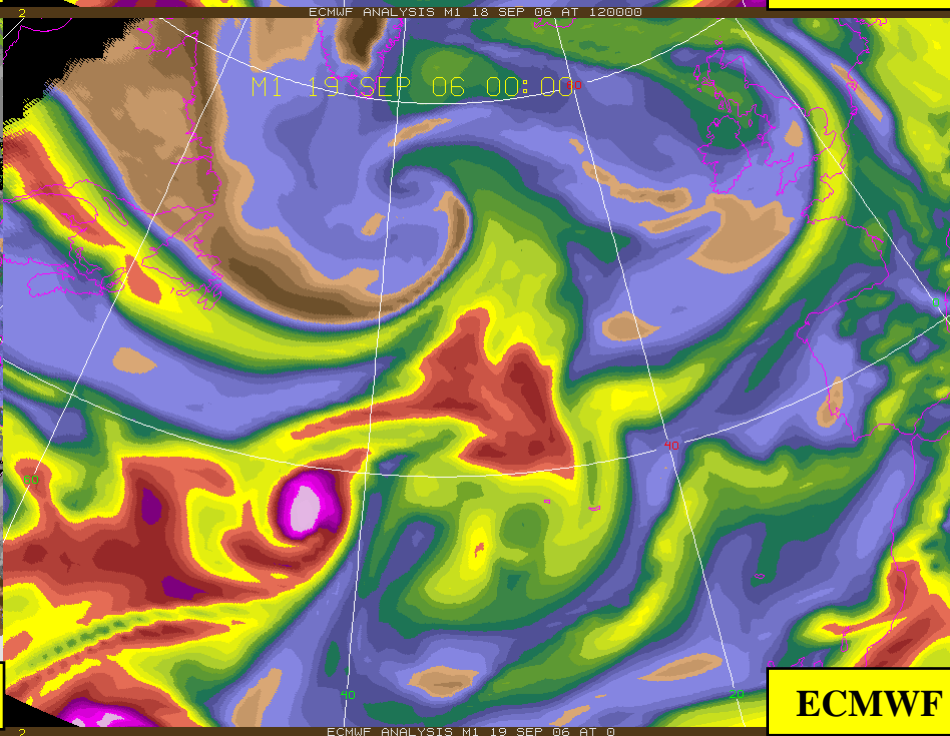
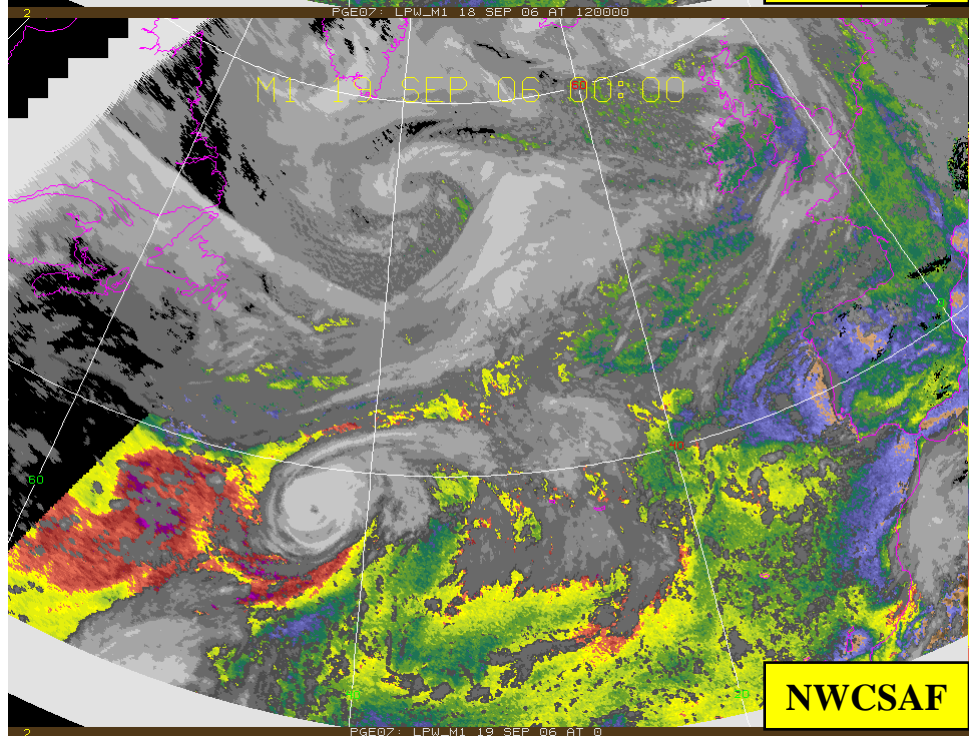
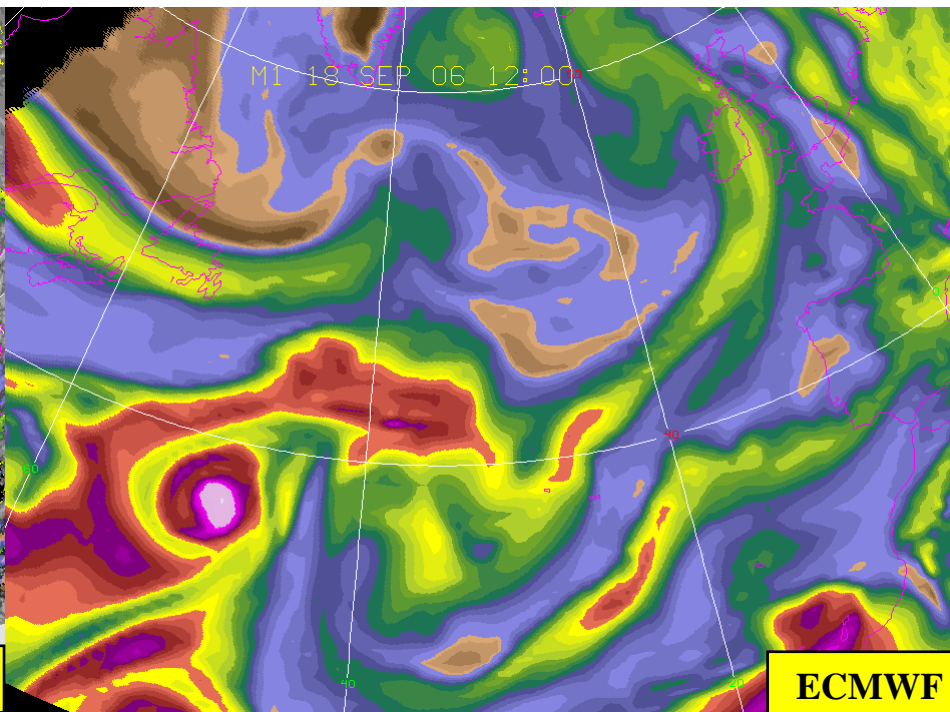
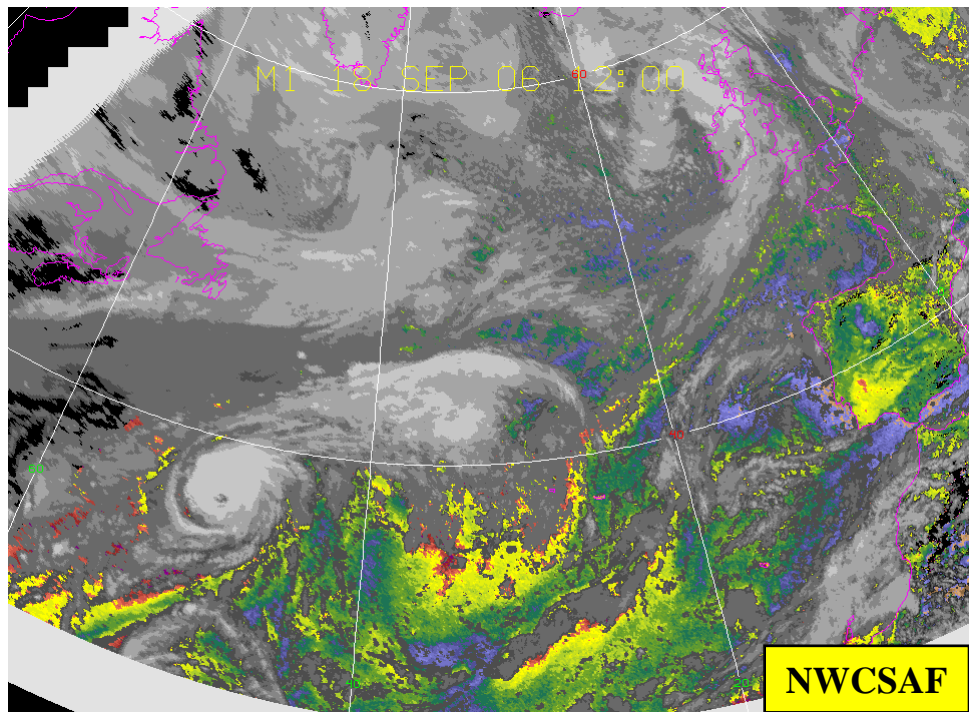


(840hPa-703 hPa)

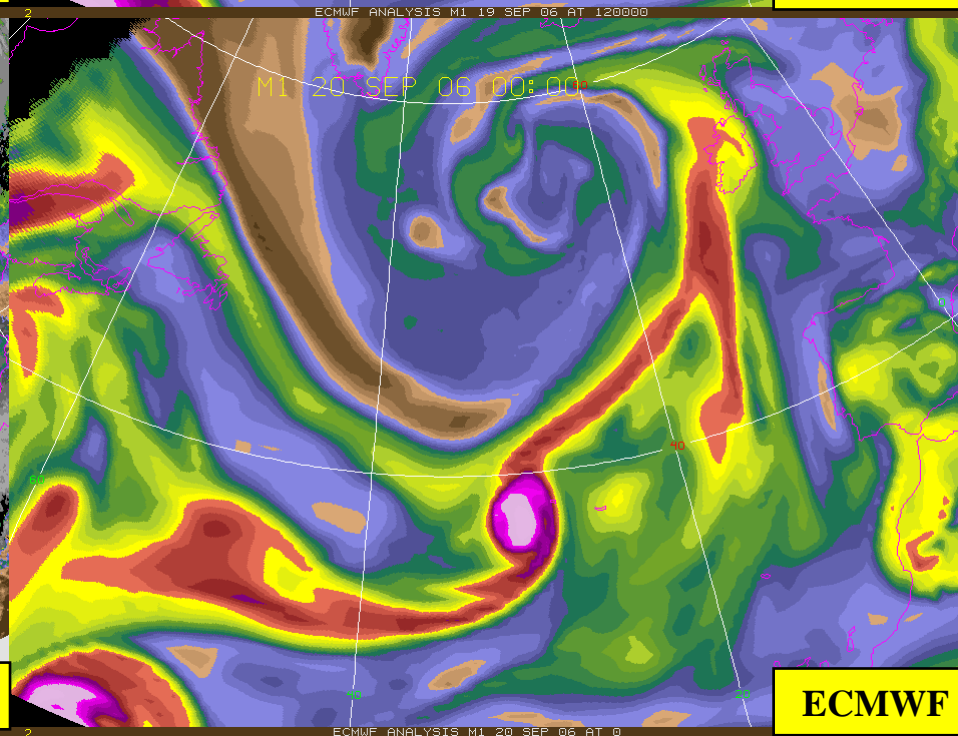
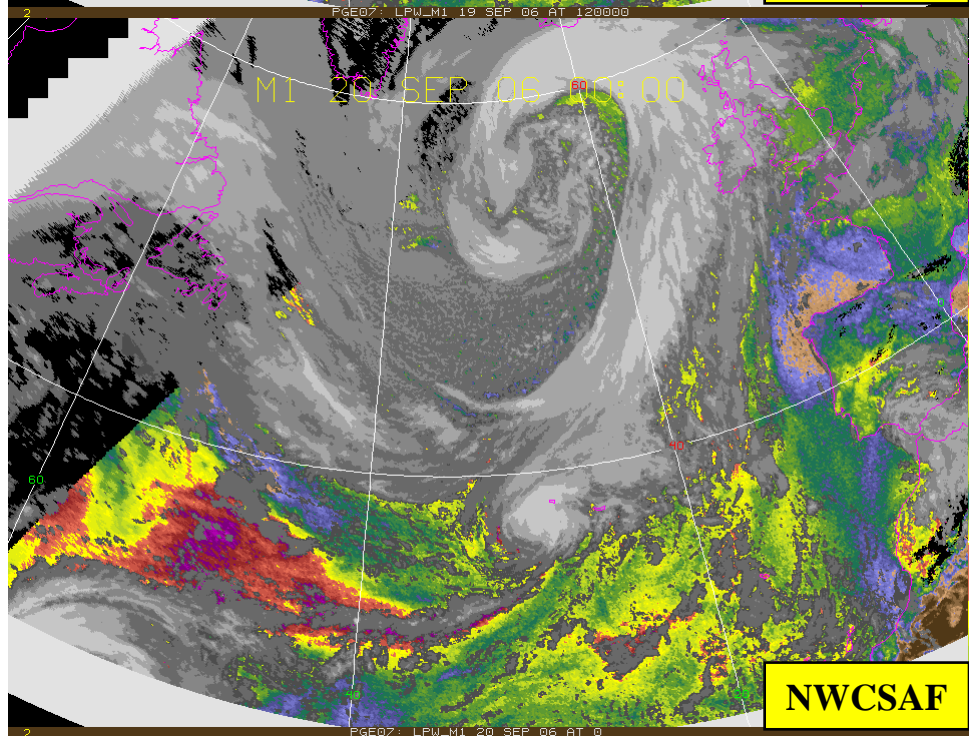
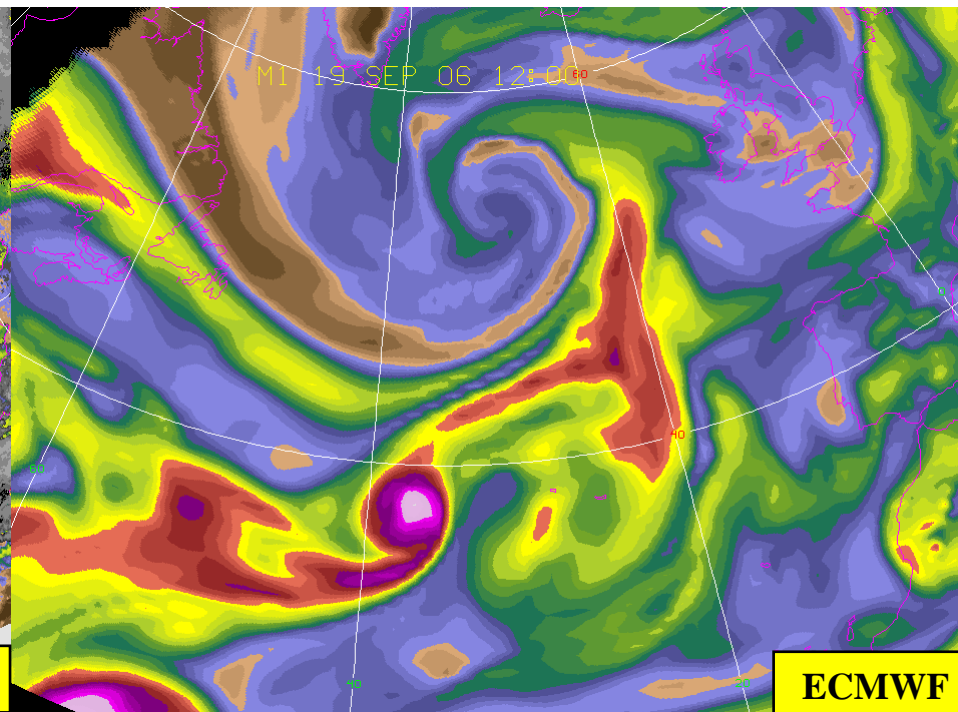
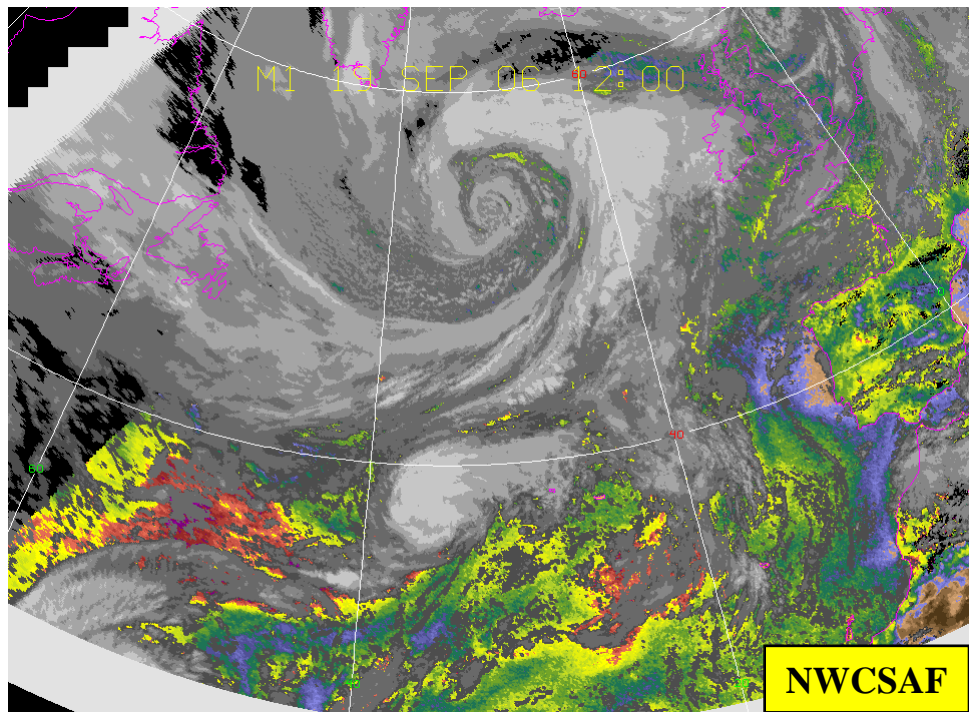




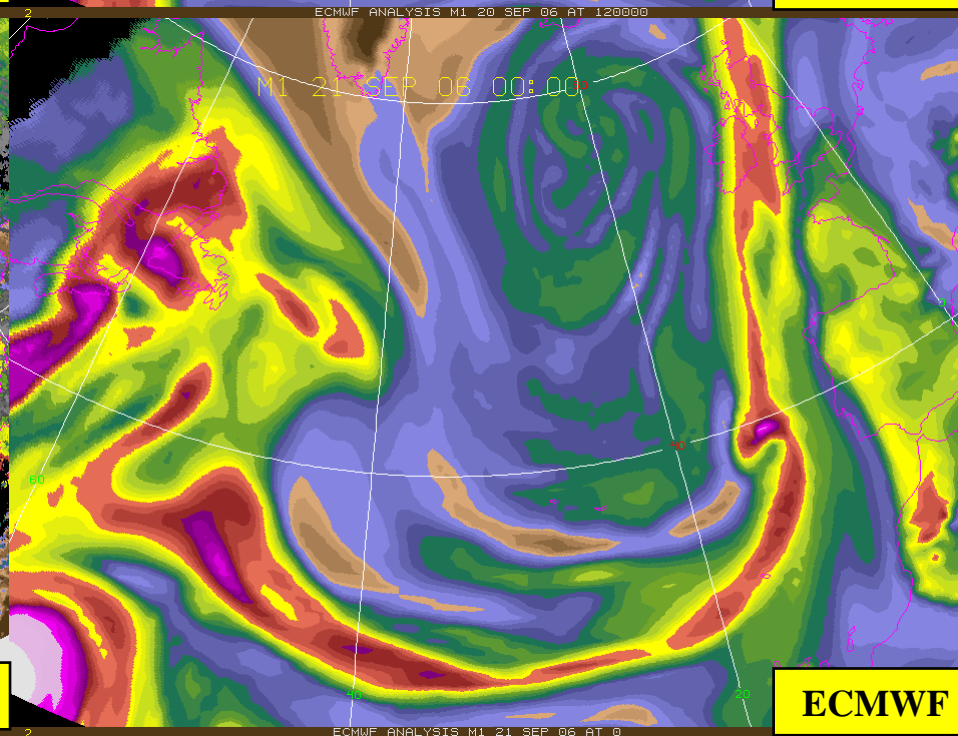
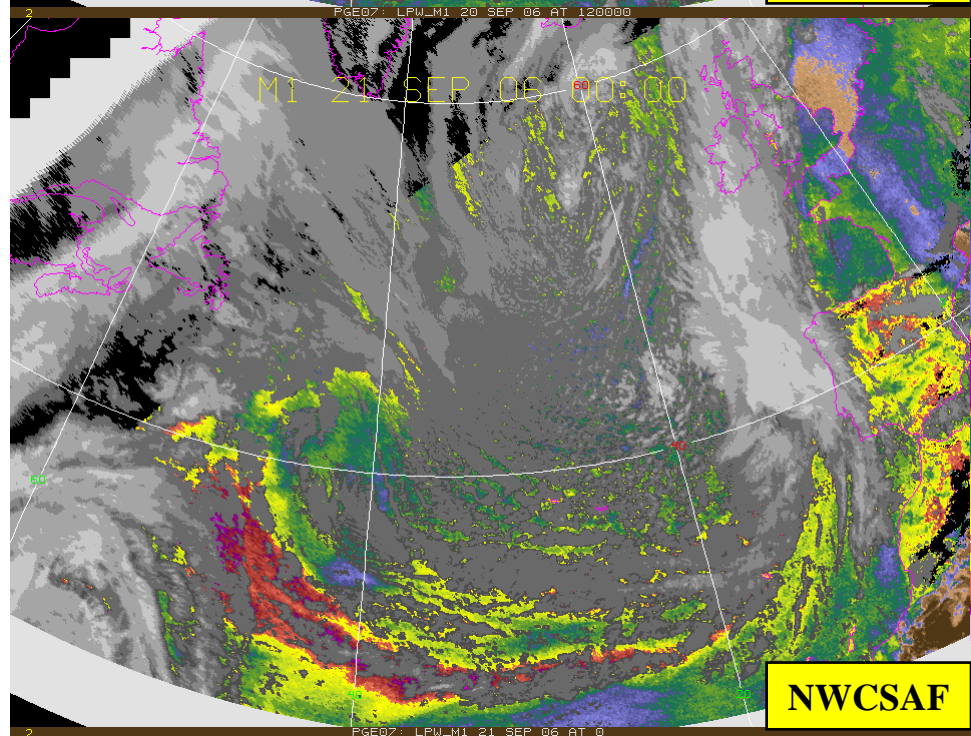
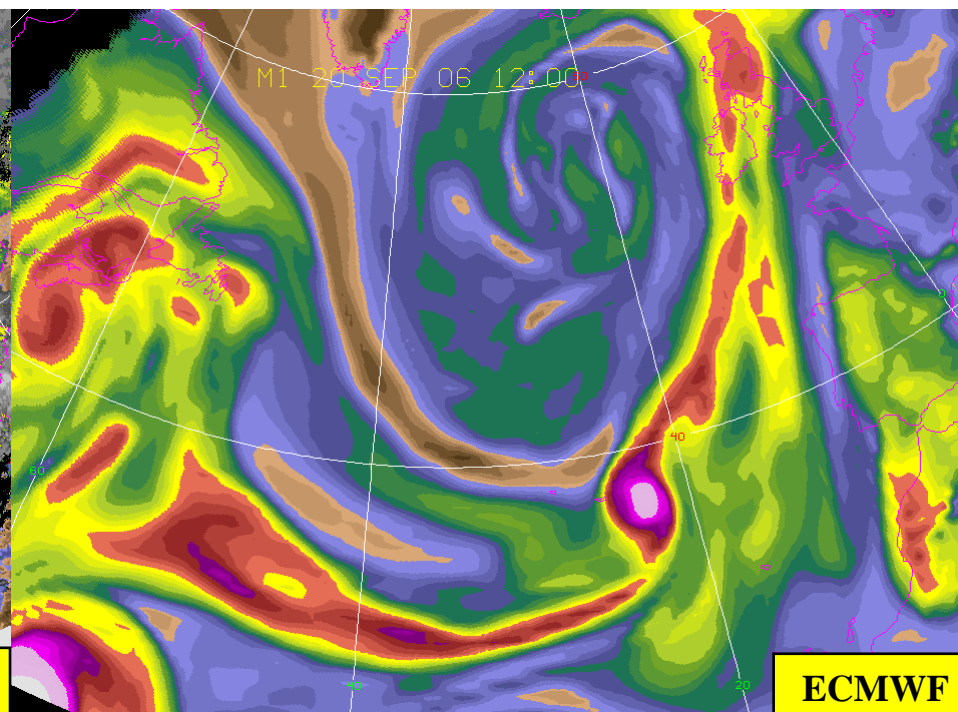
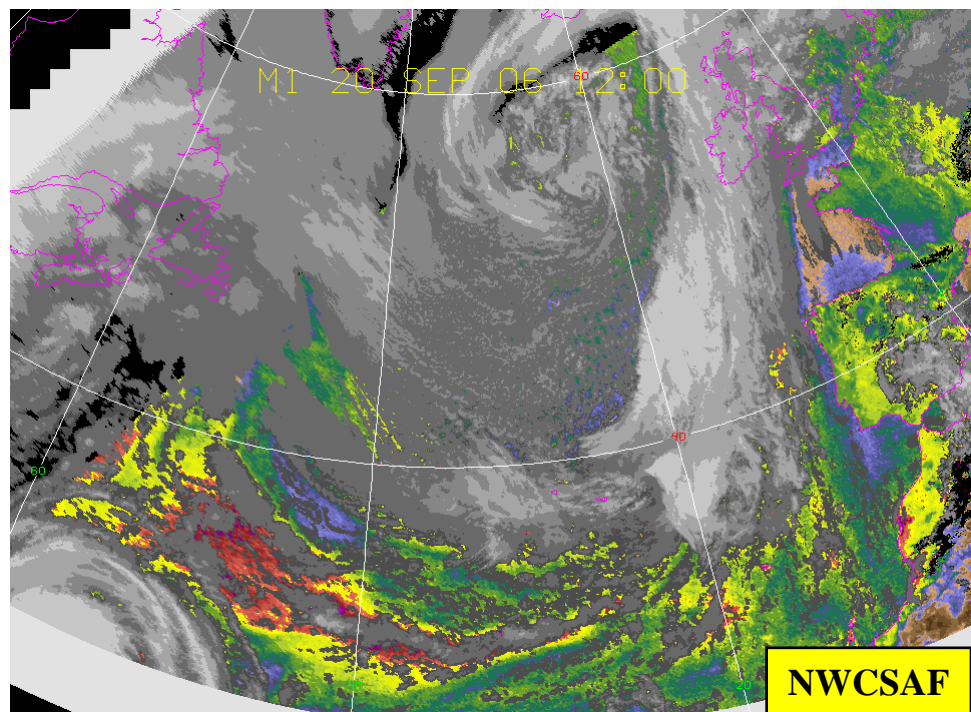








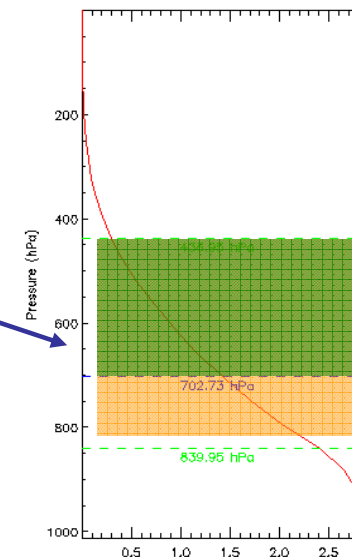




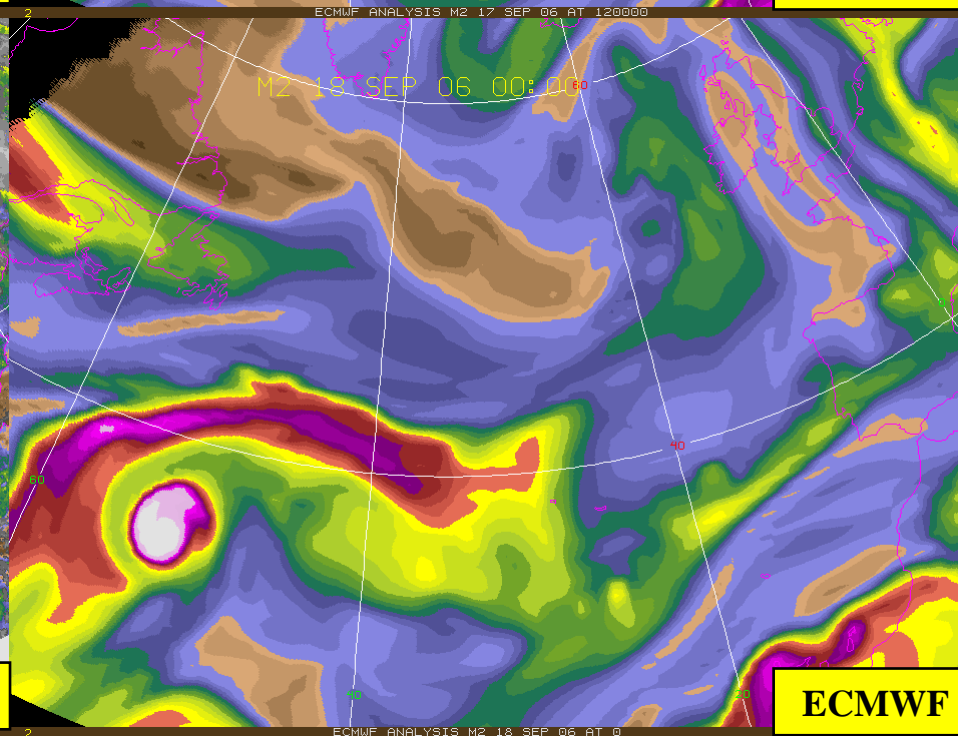
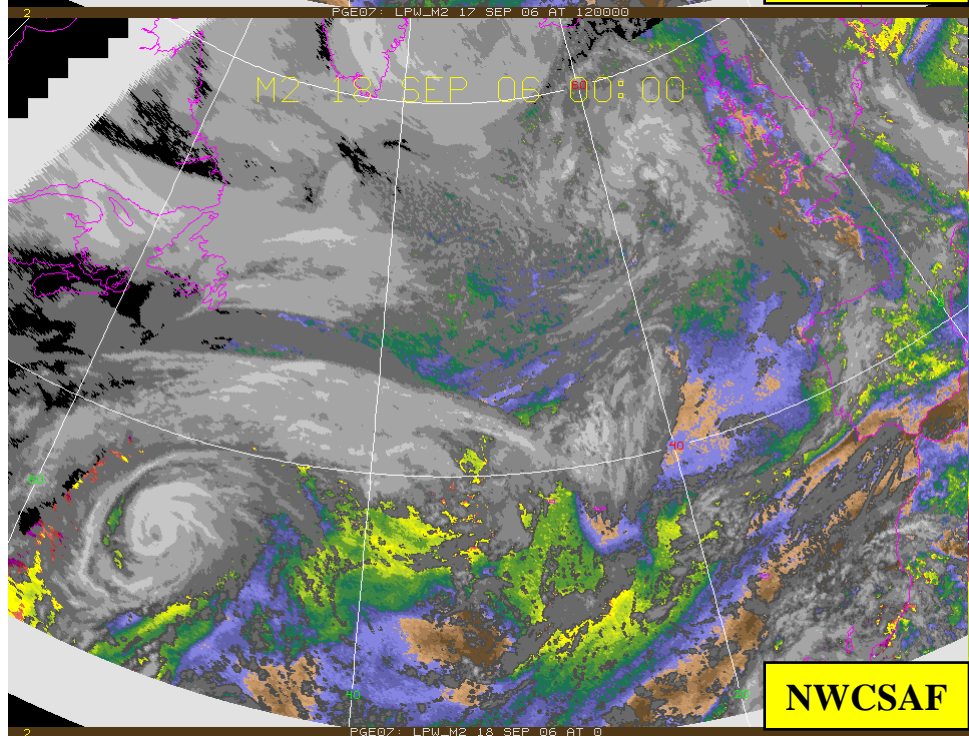
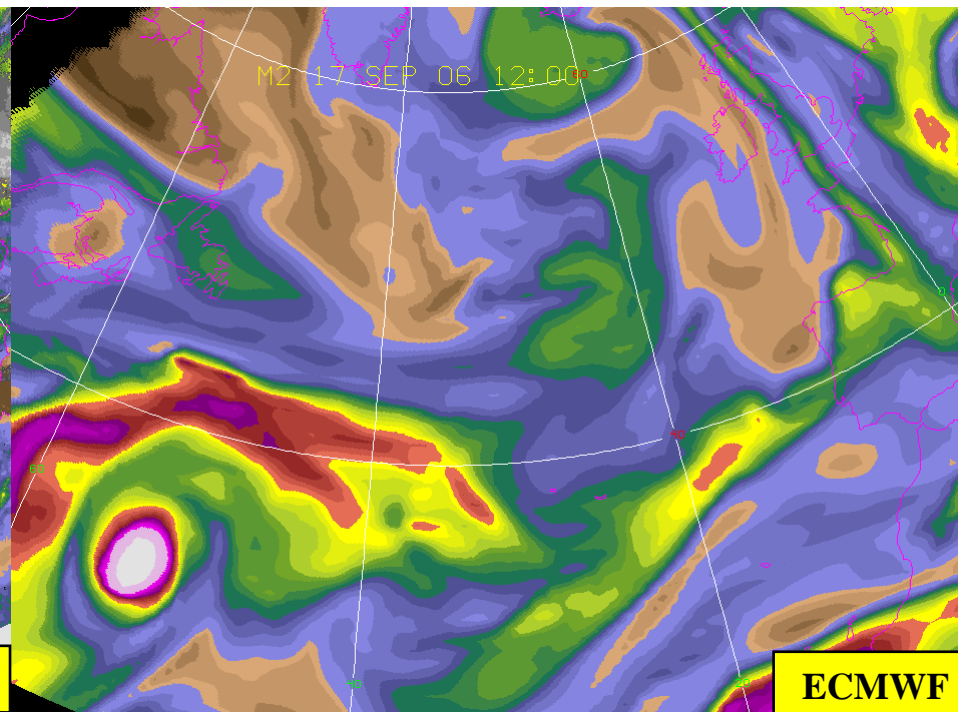
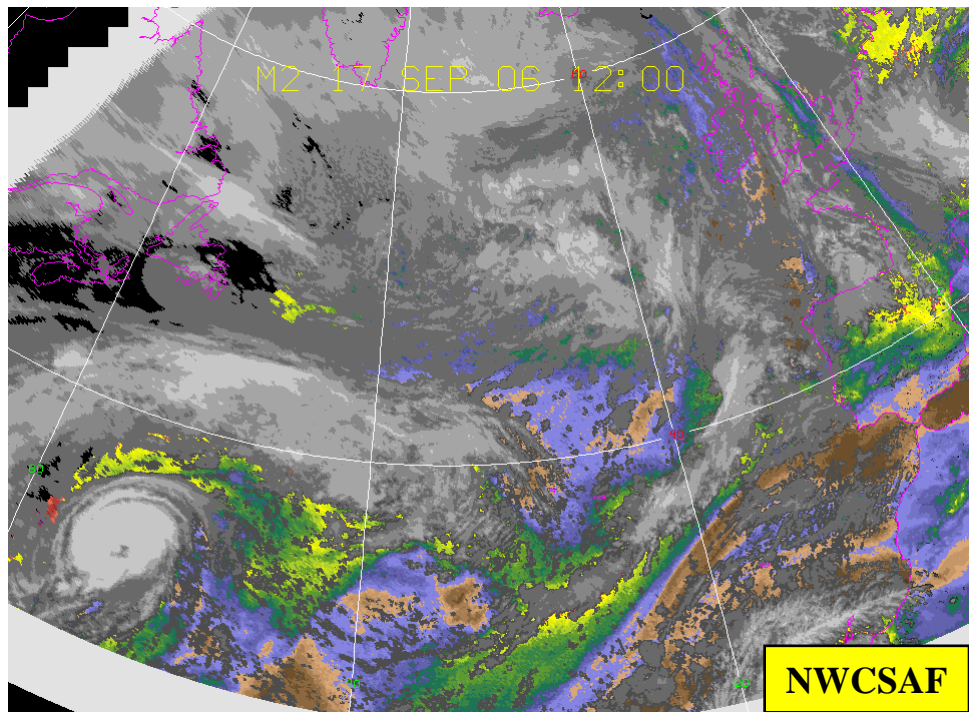
# GORDON Hurricane comparison NWCSAF/MSG M2 images VS ECMWF M2



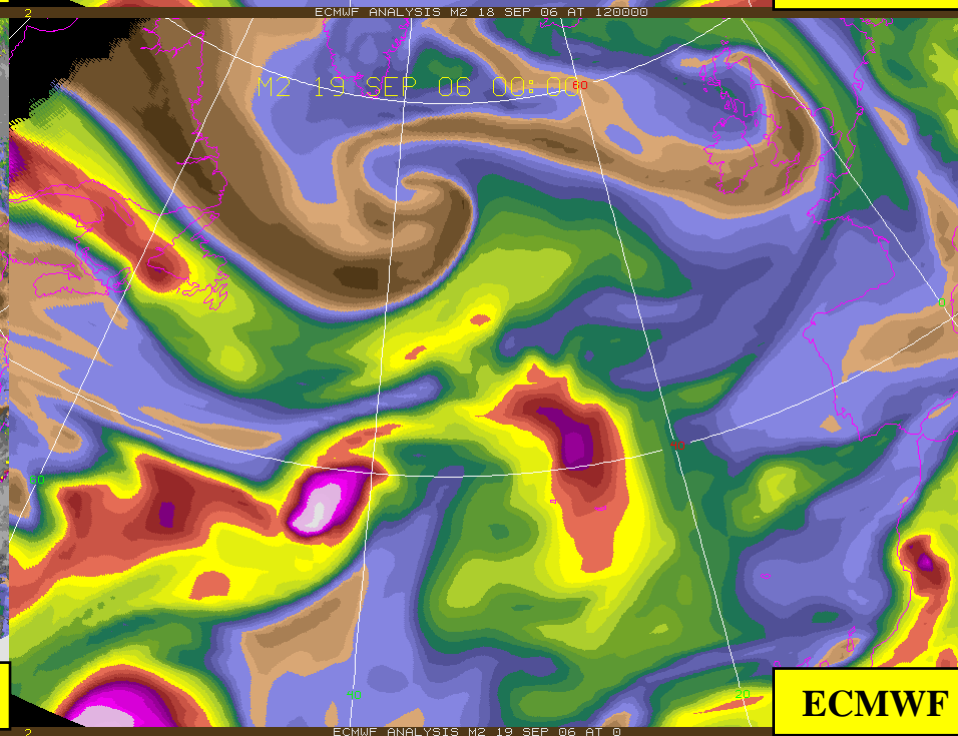
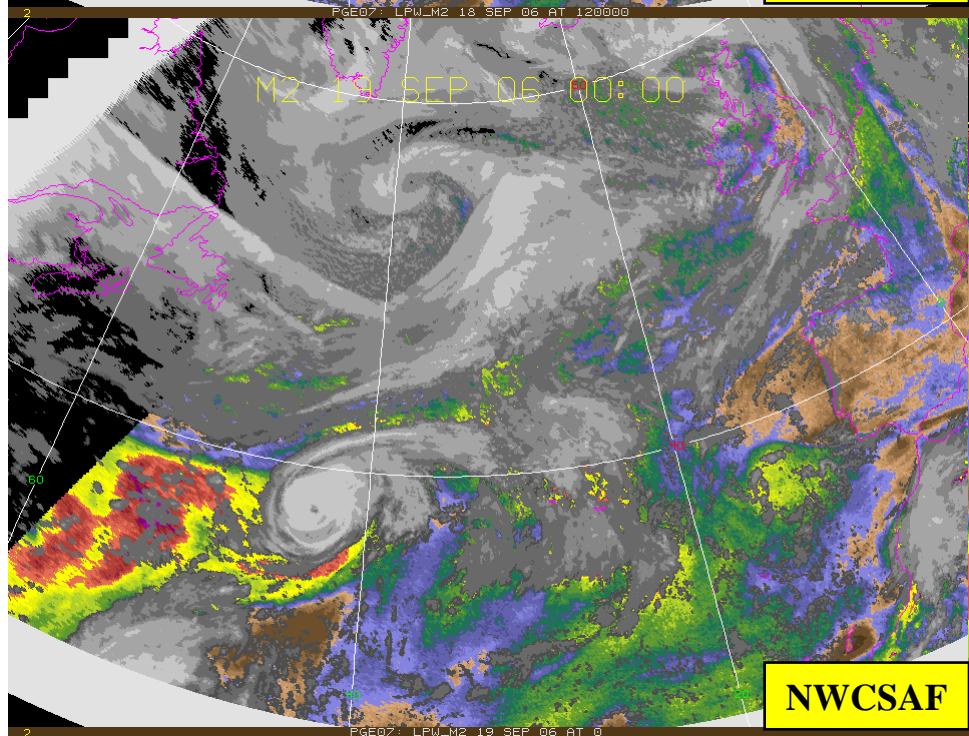
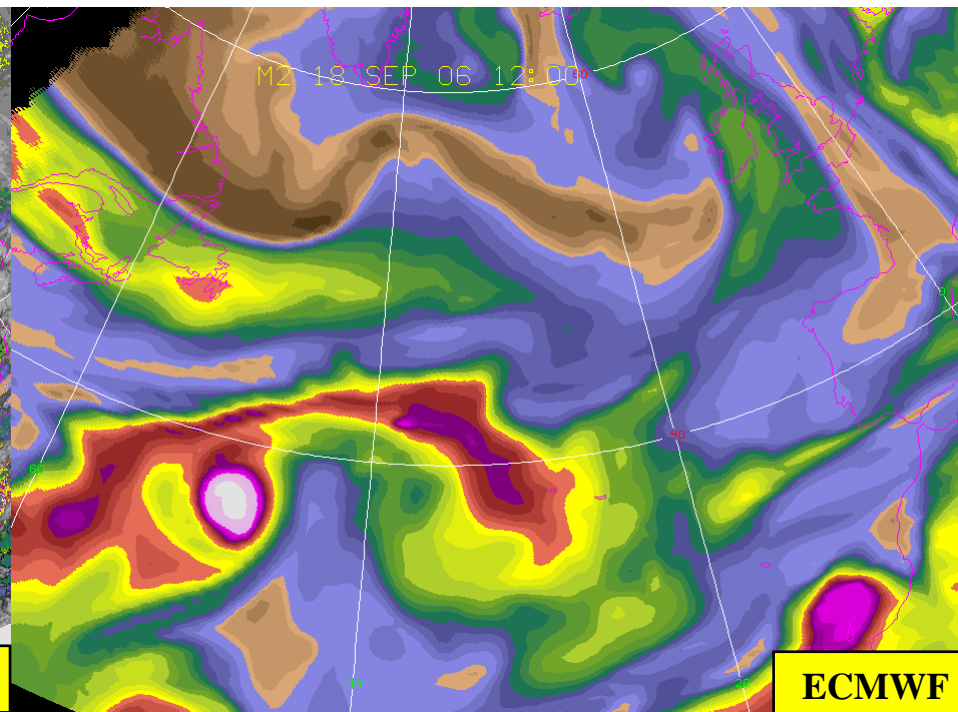
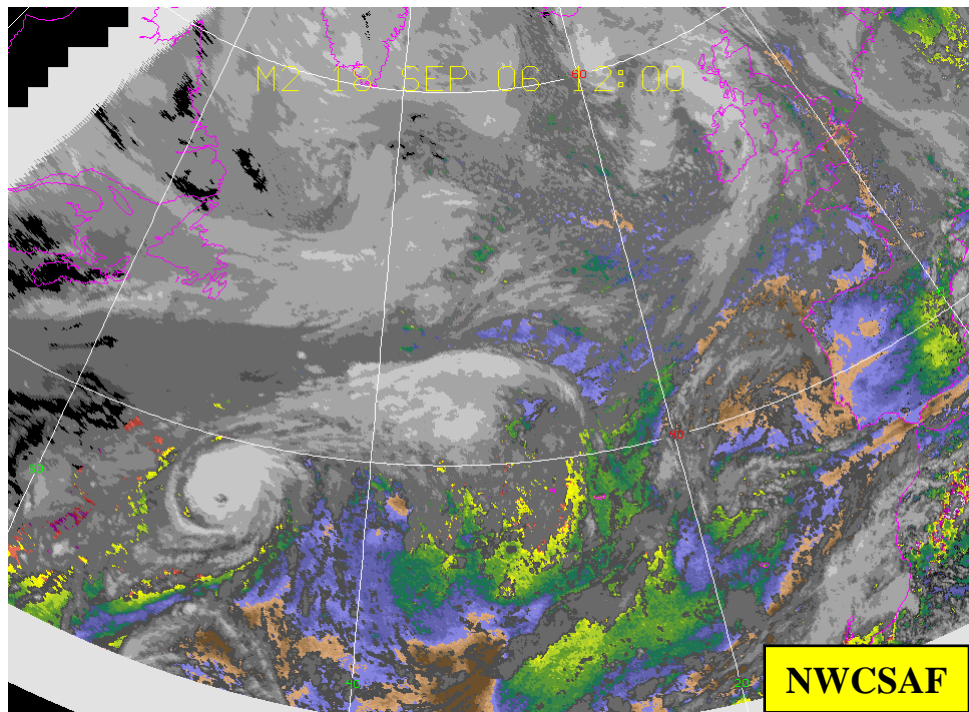
(703 hPa-437hPa)



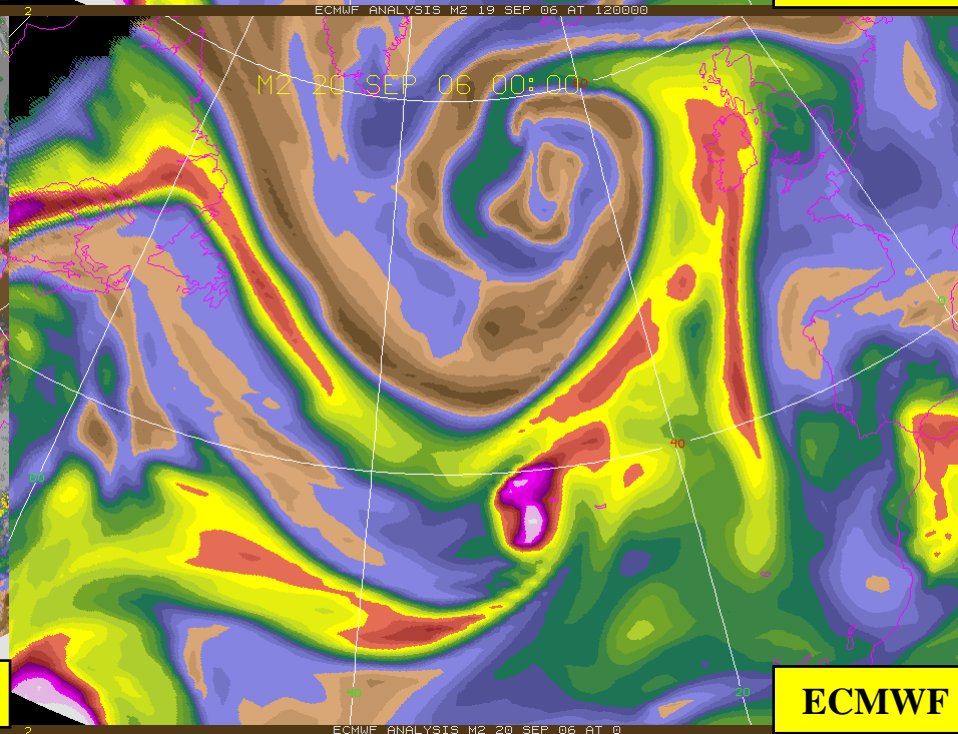
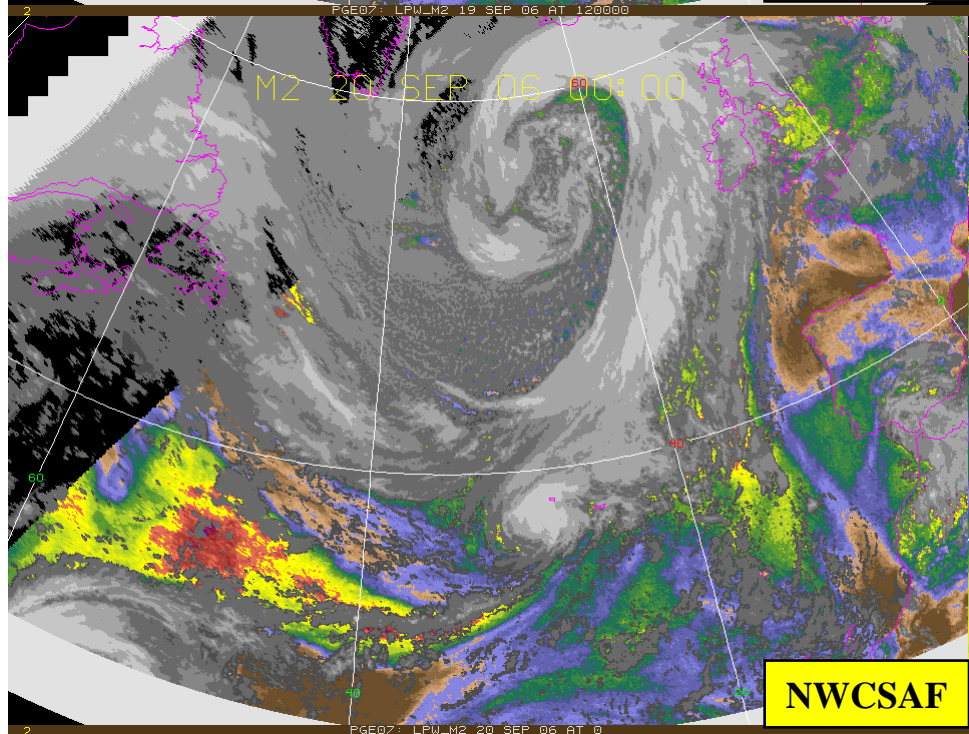
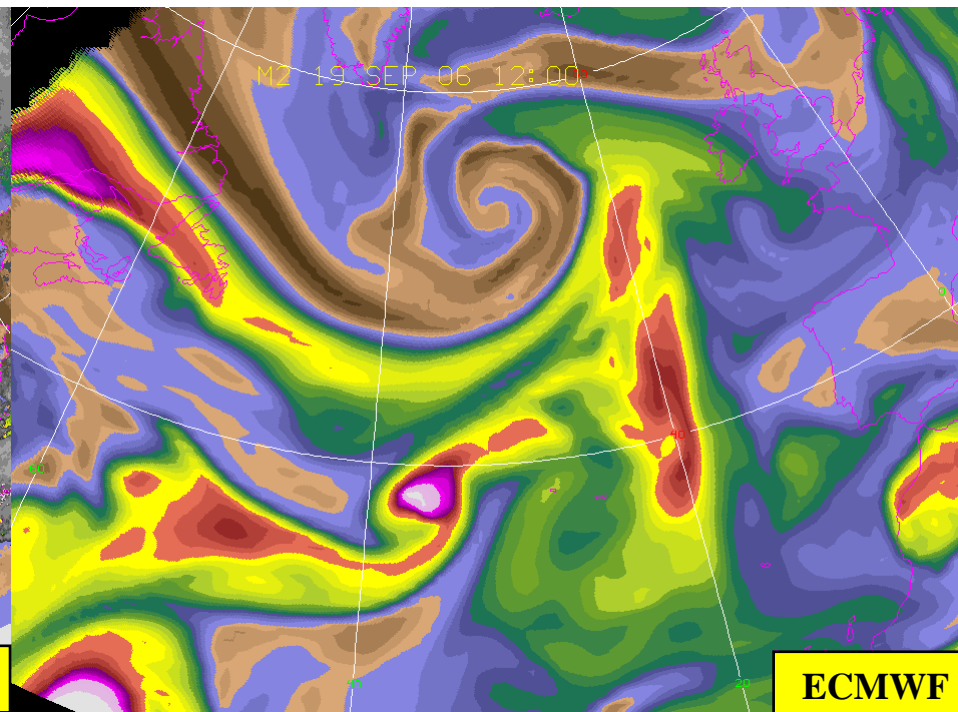
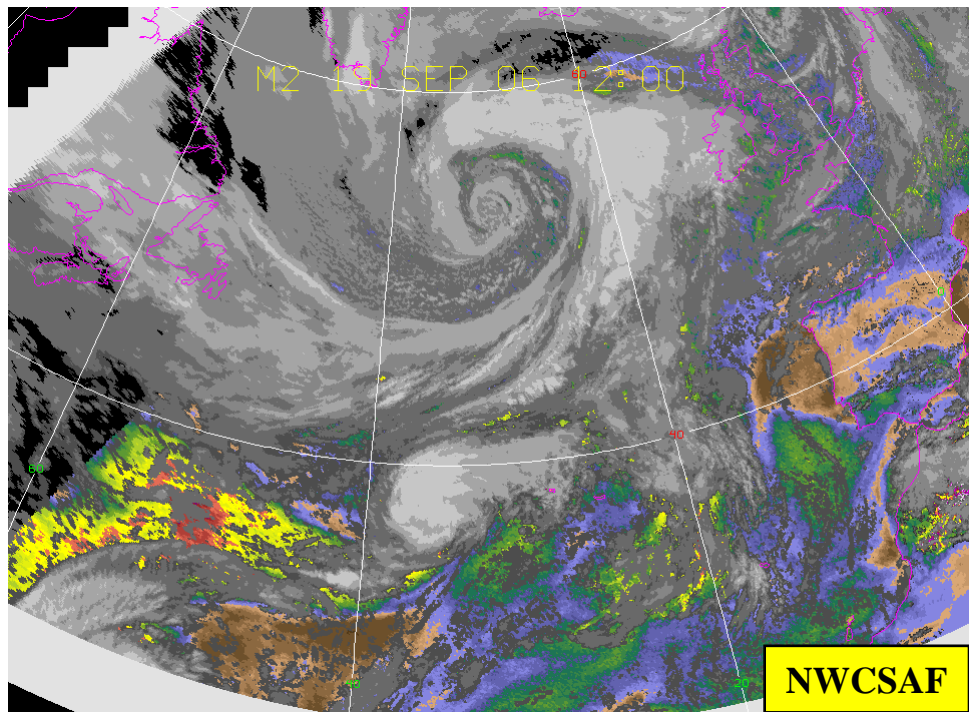




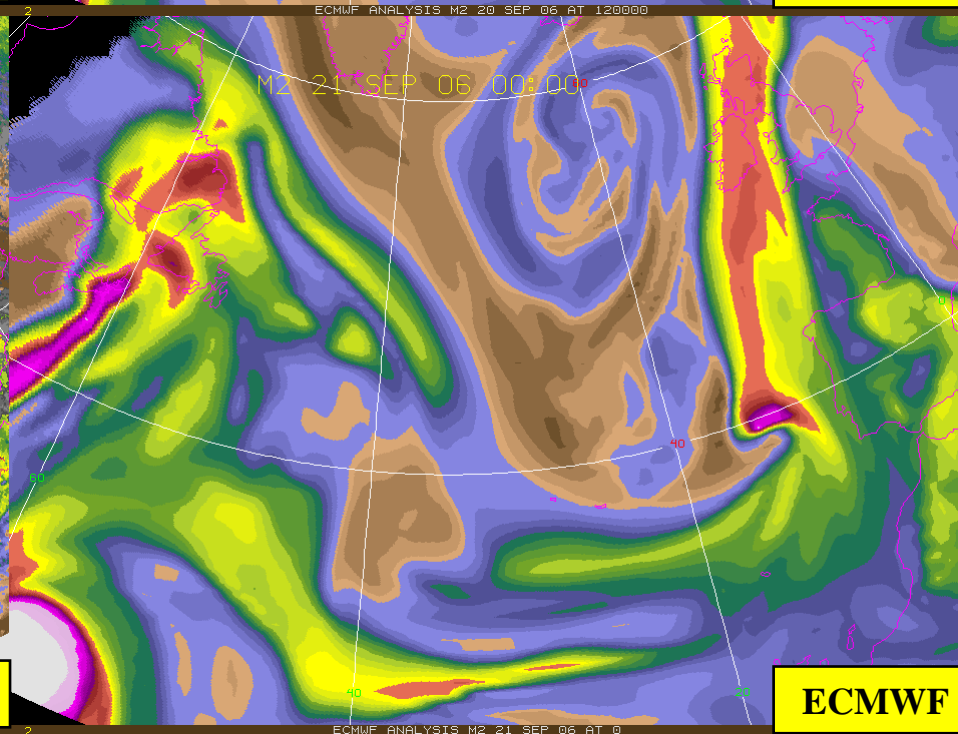
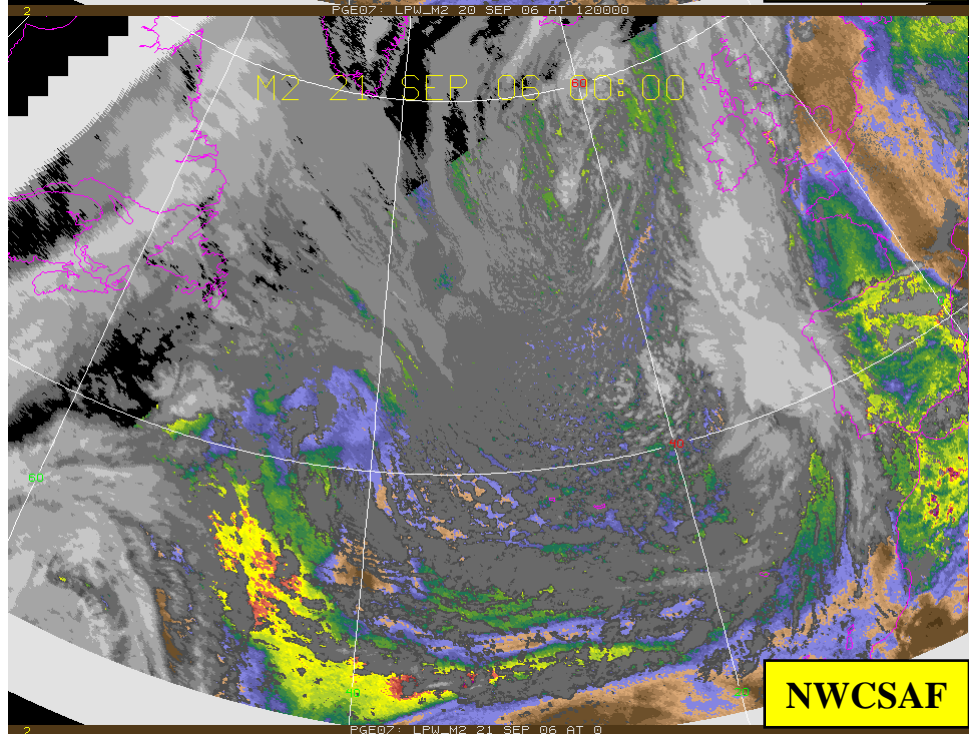
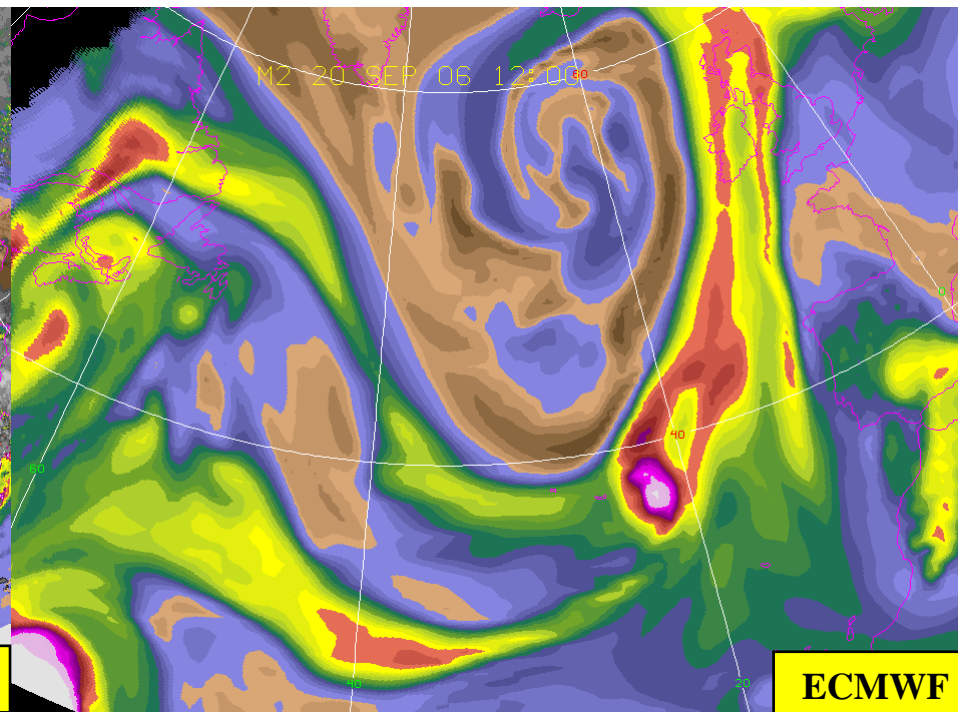
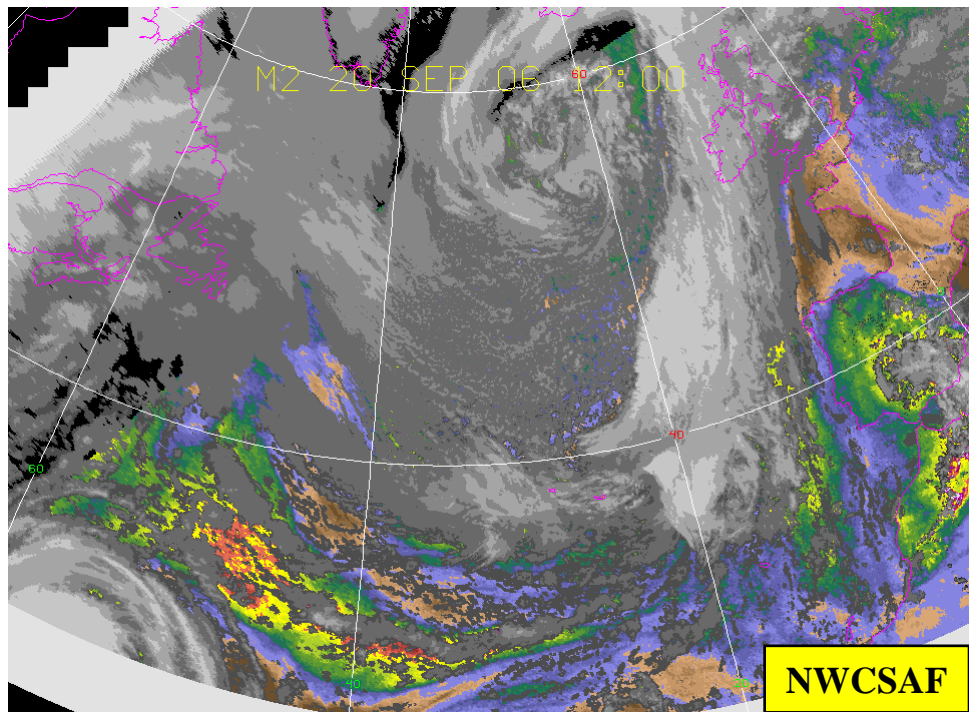




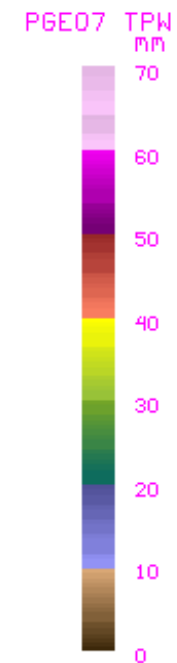




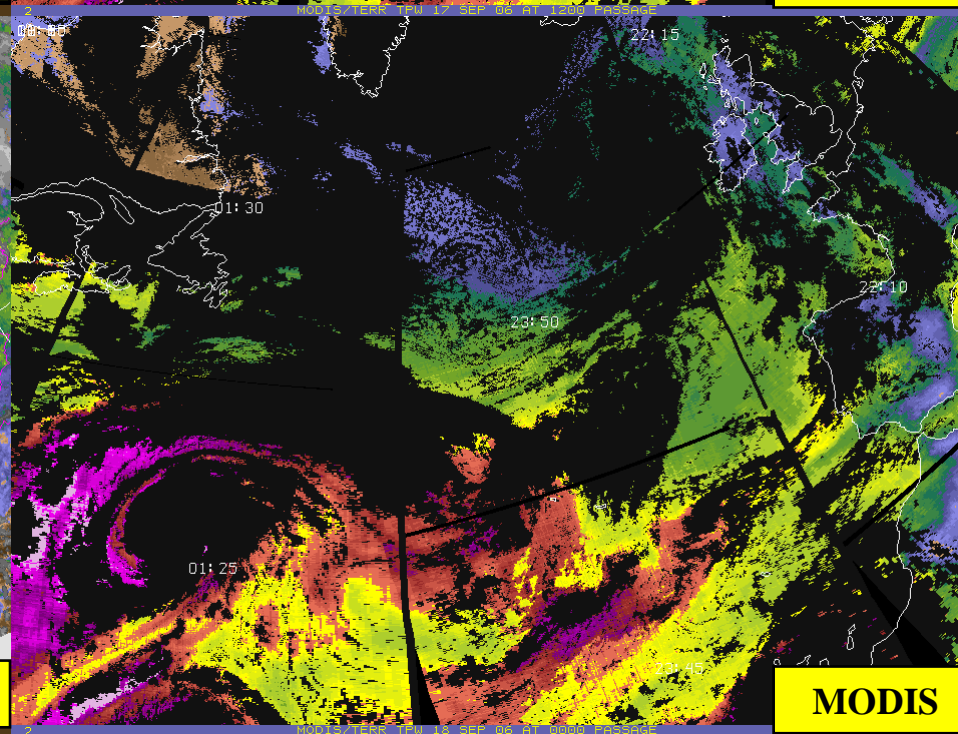
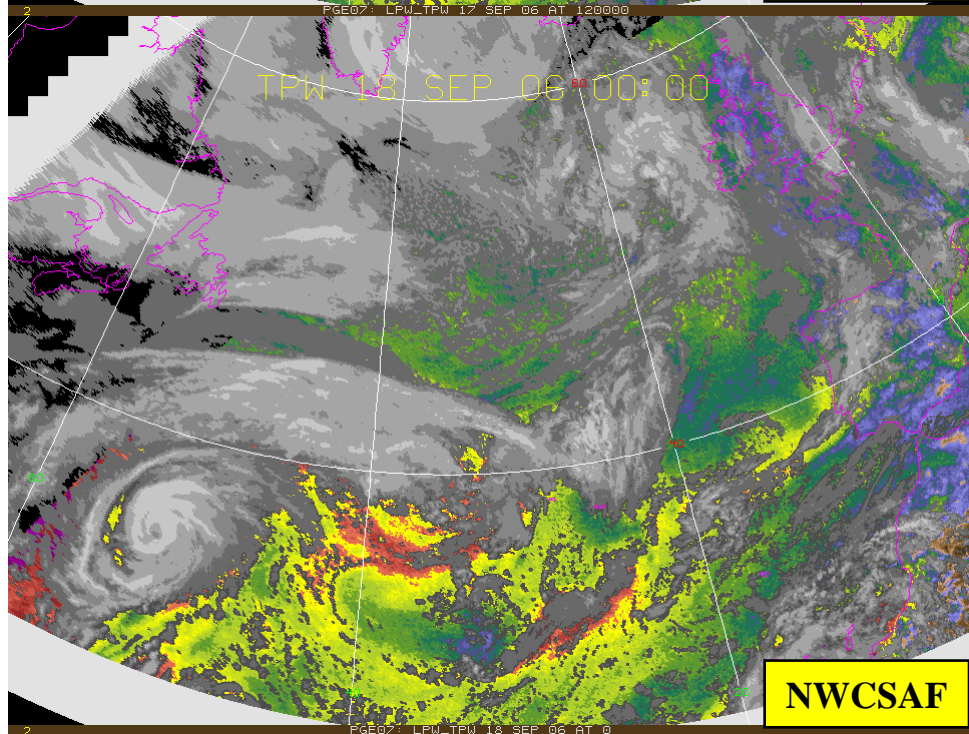
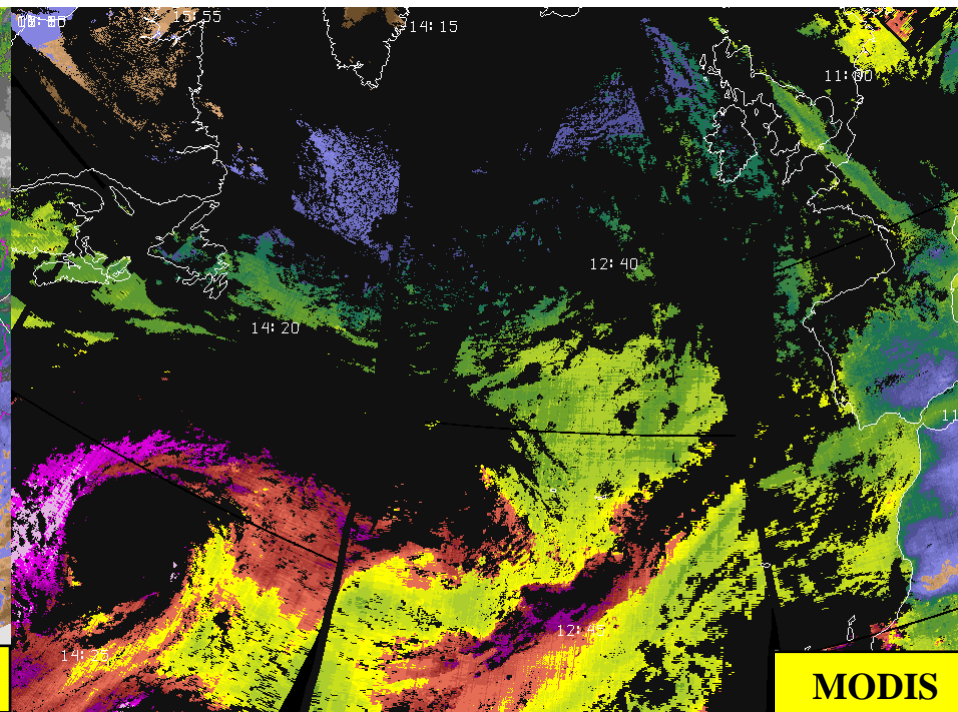
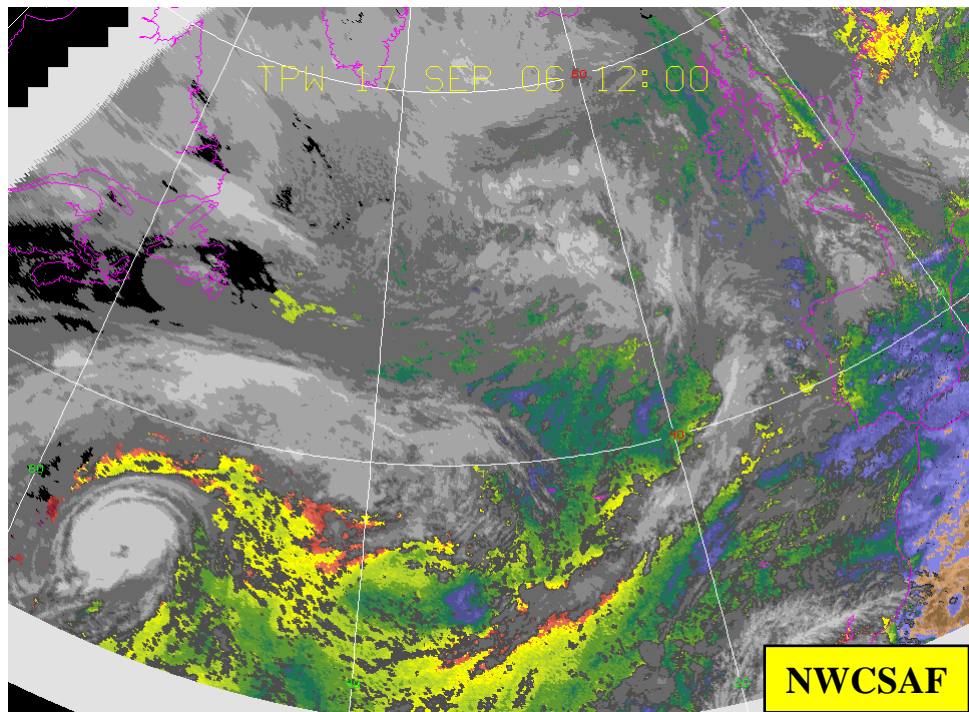




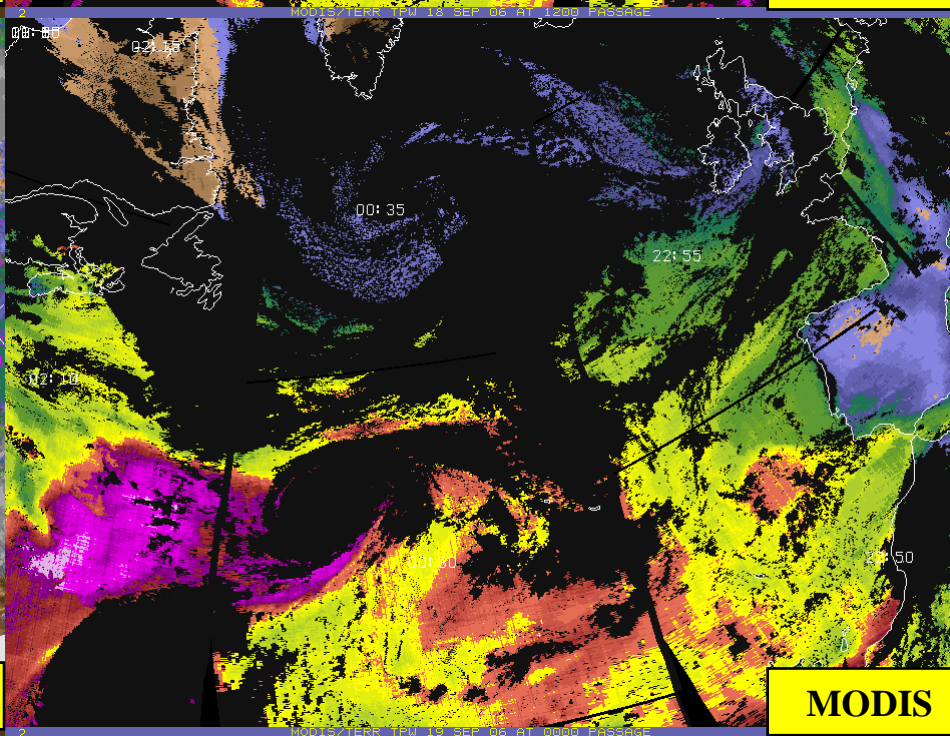
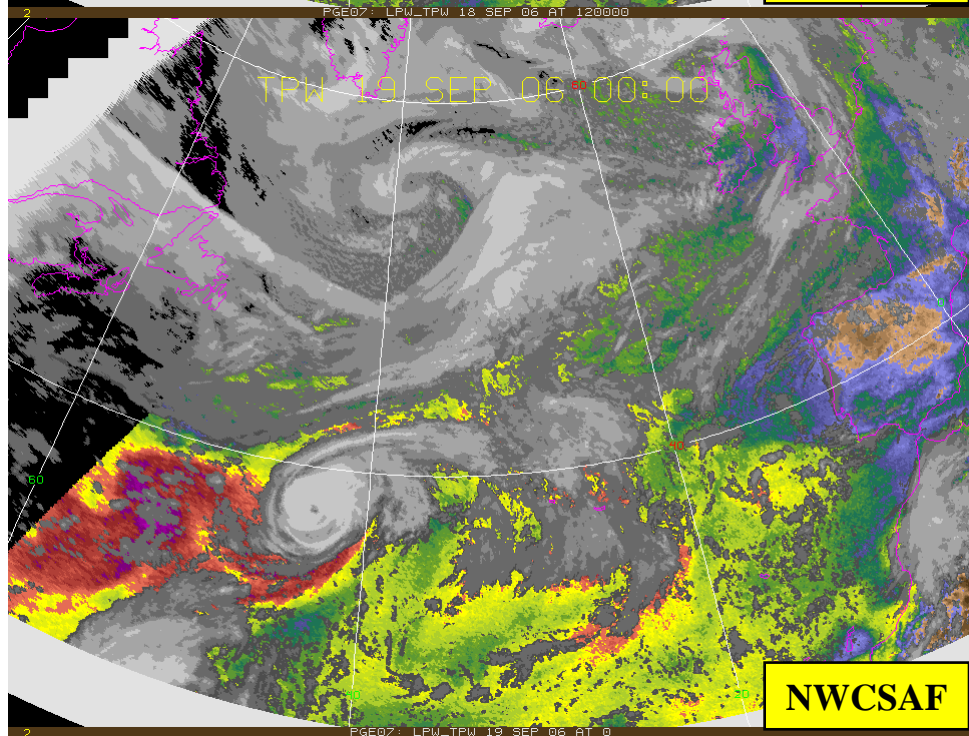
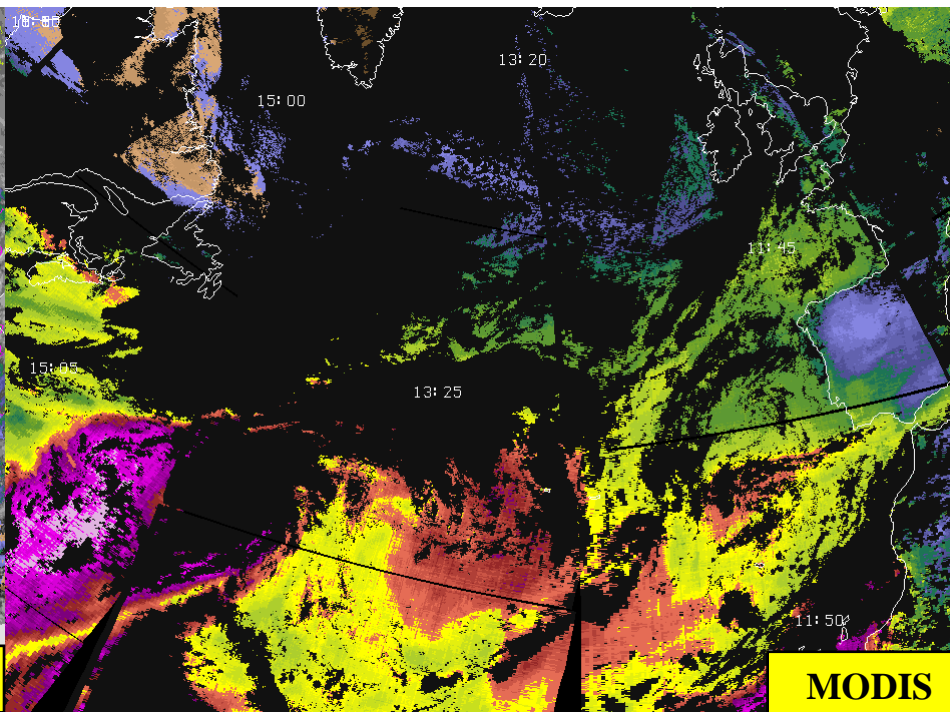
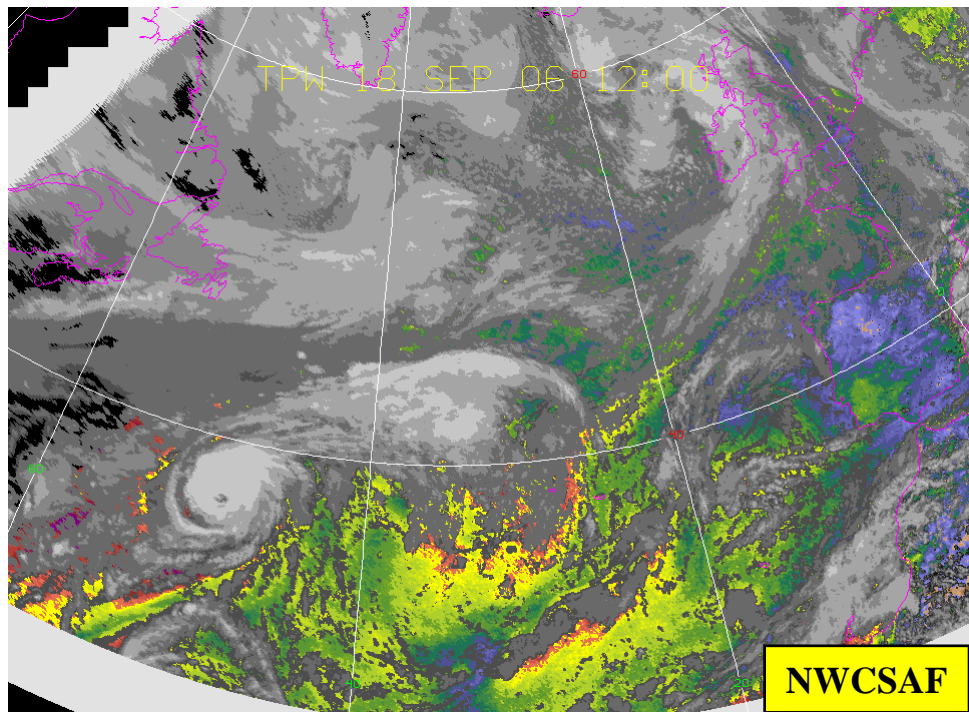
# GORDON Hurricane comparison NWCSAF/MSG TPW images VS MODIS/TERRA TPW



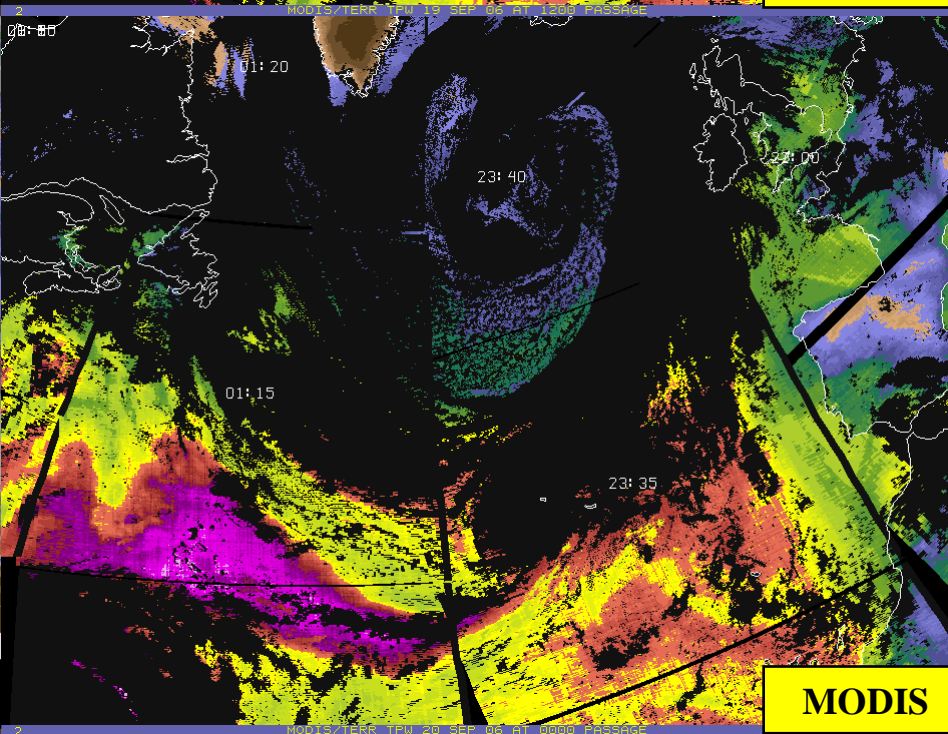
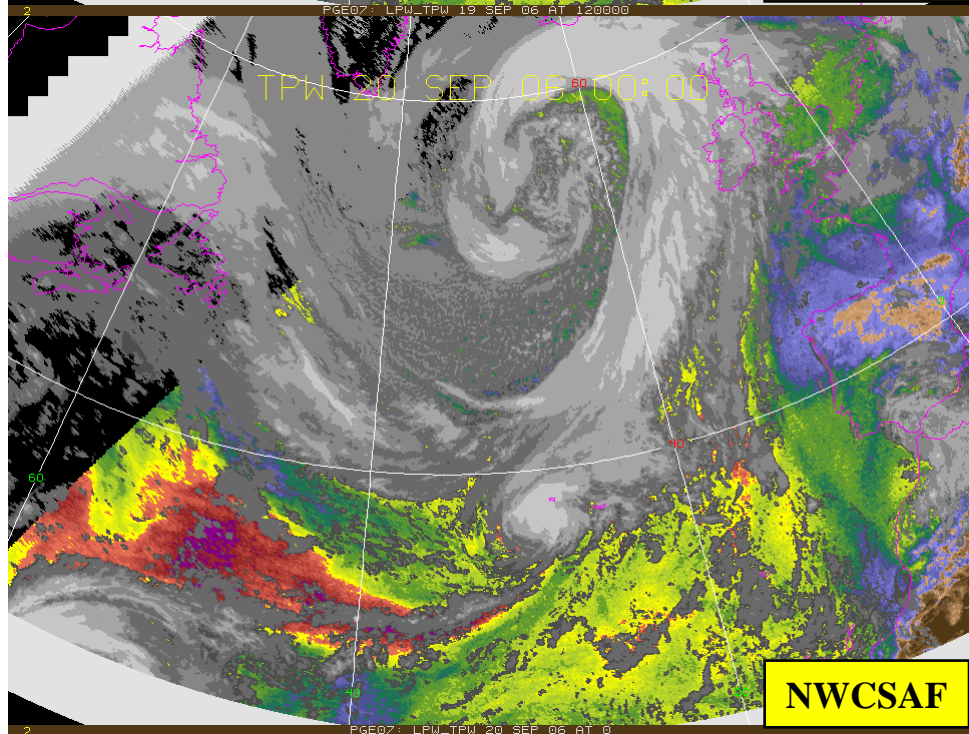
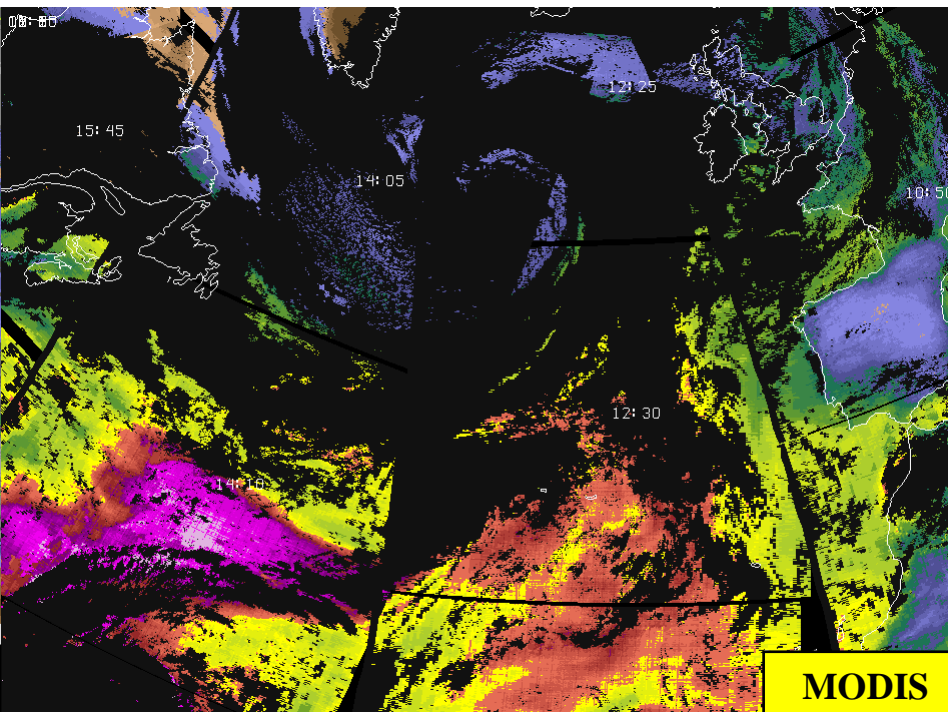
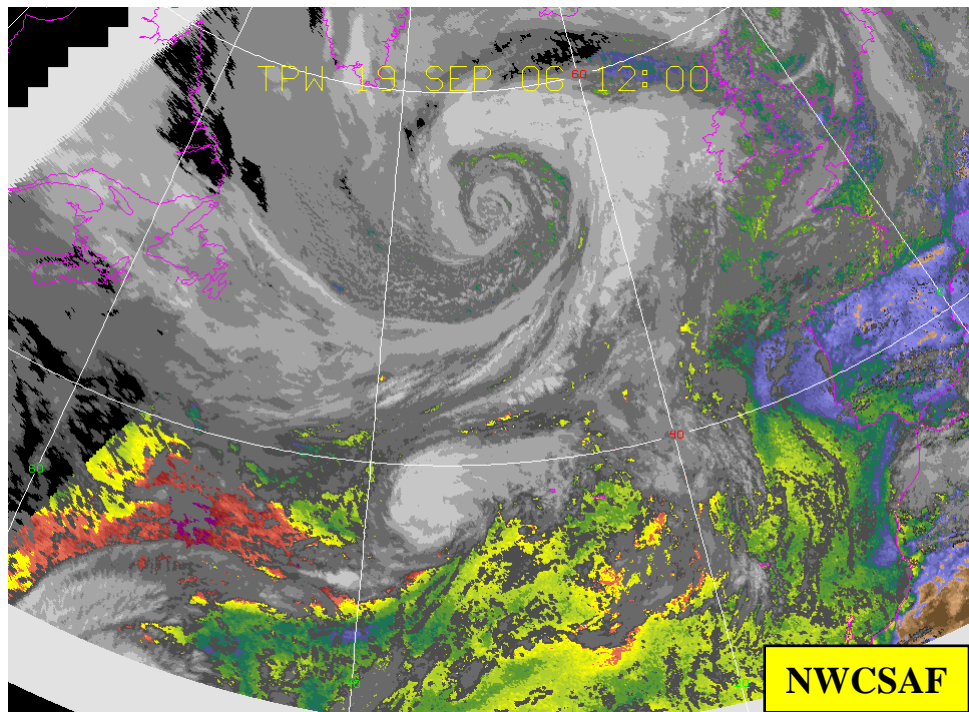




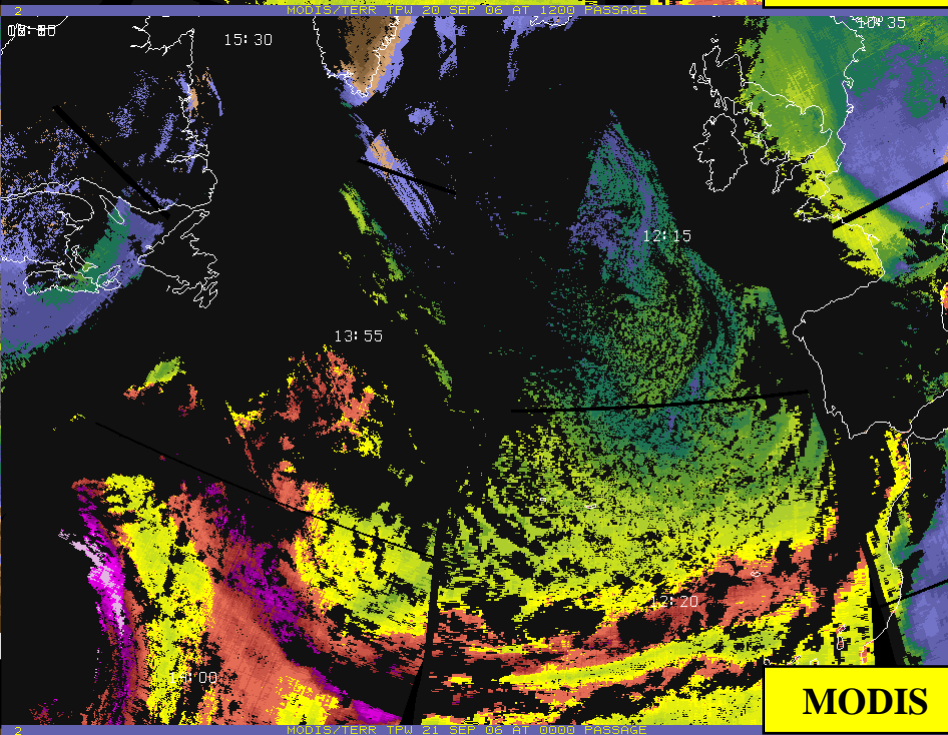
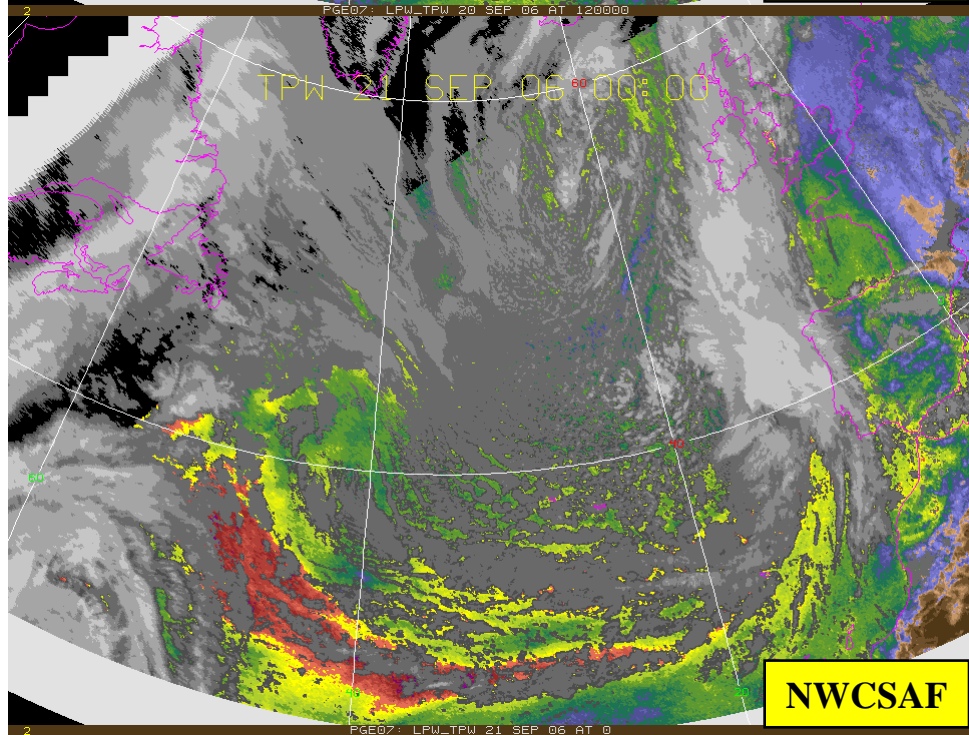
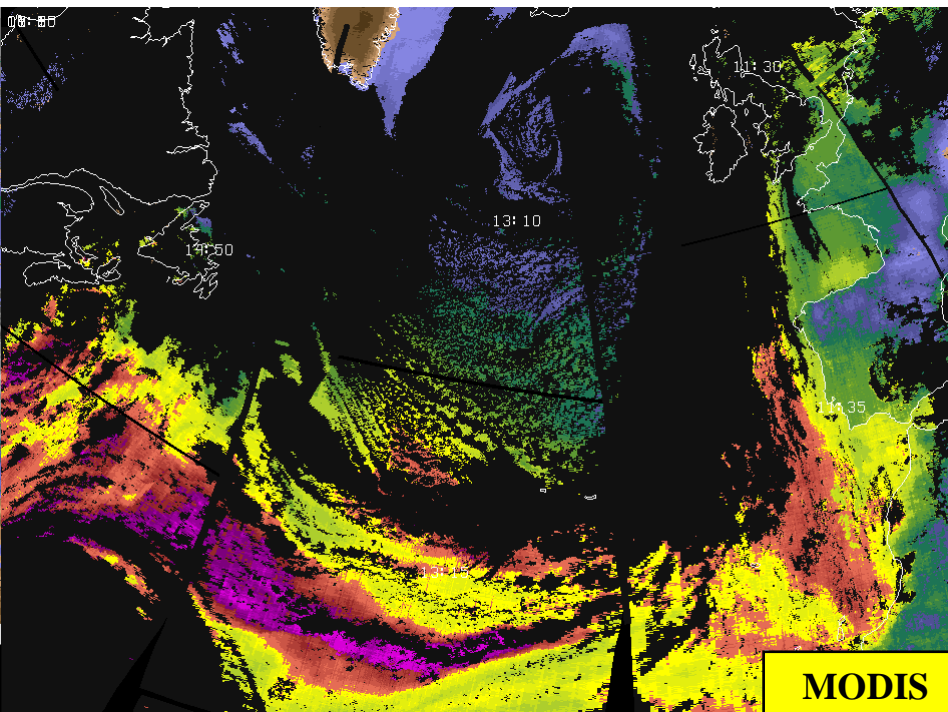
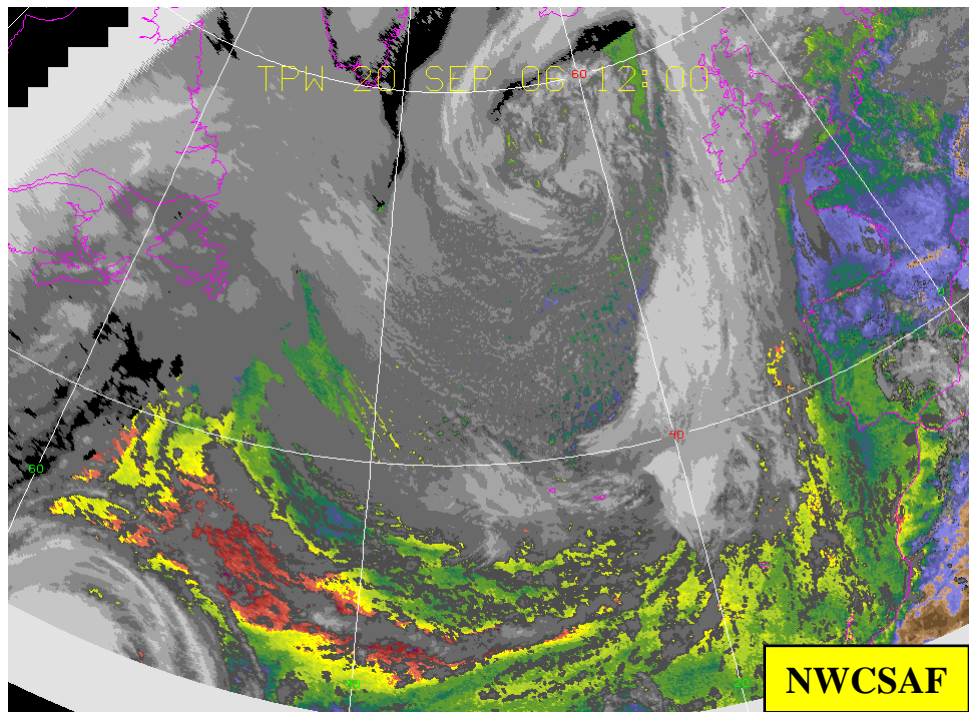




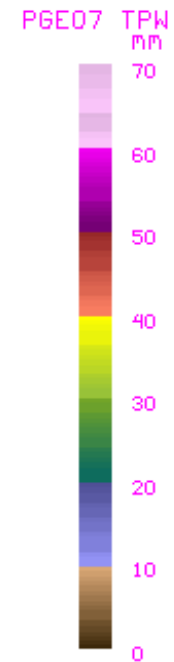




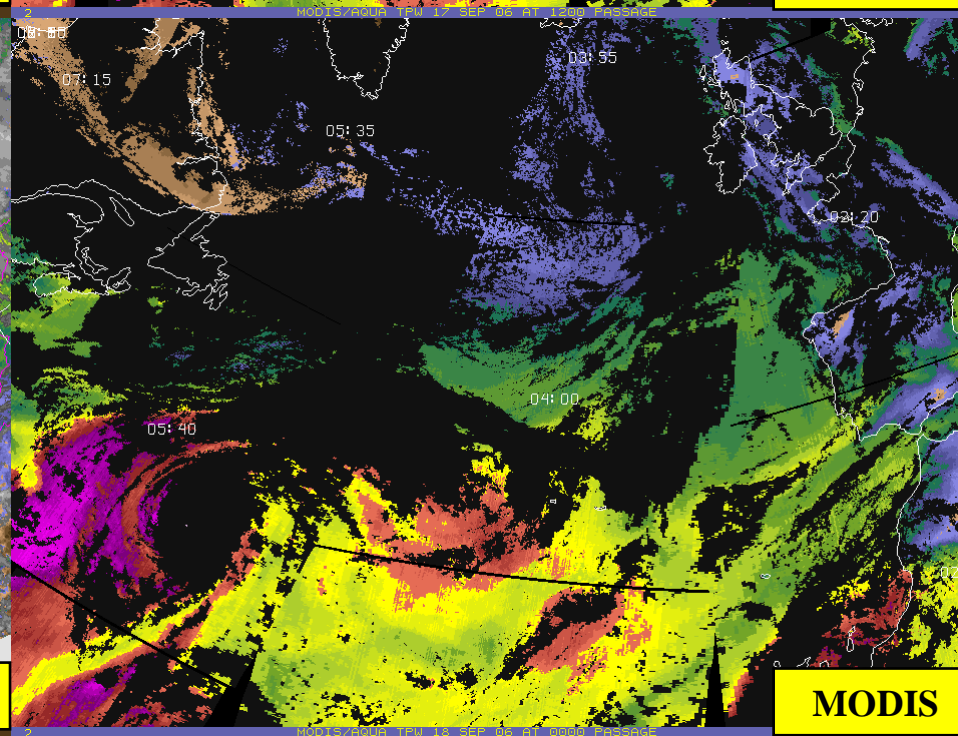
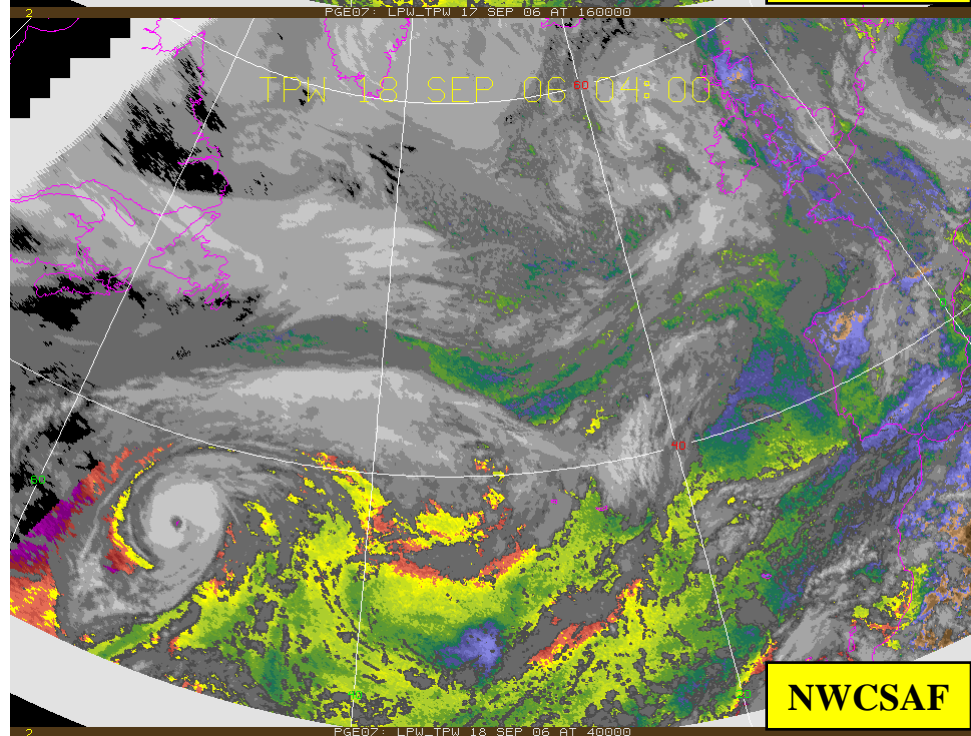
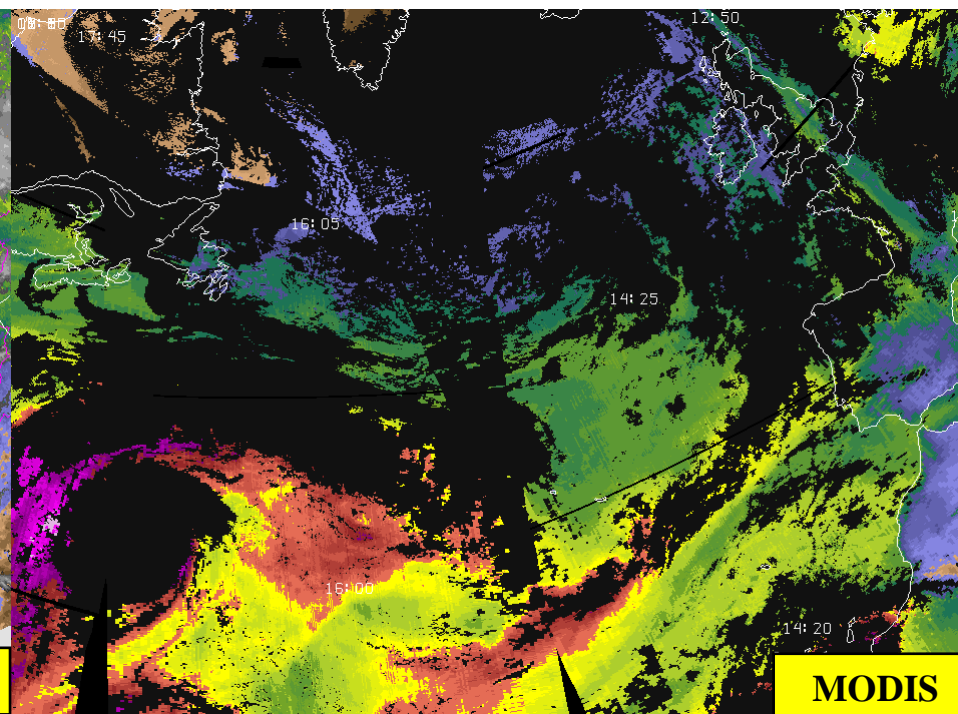
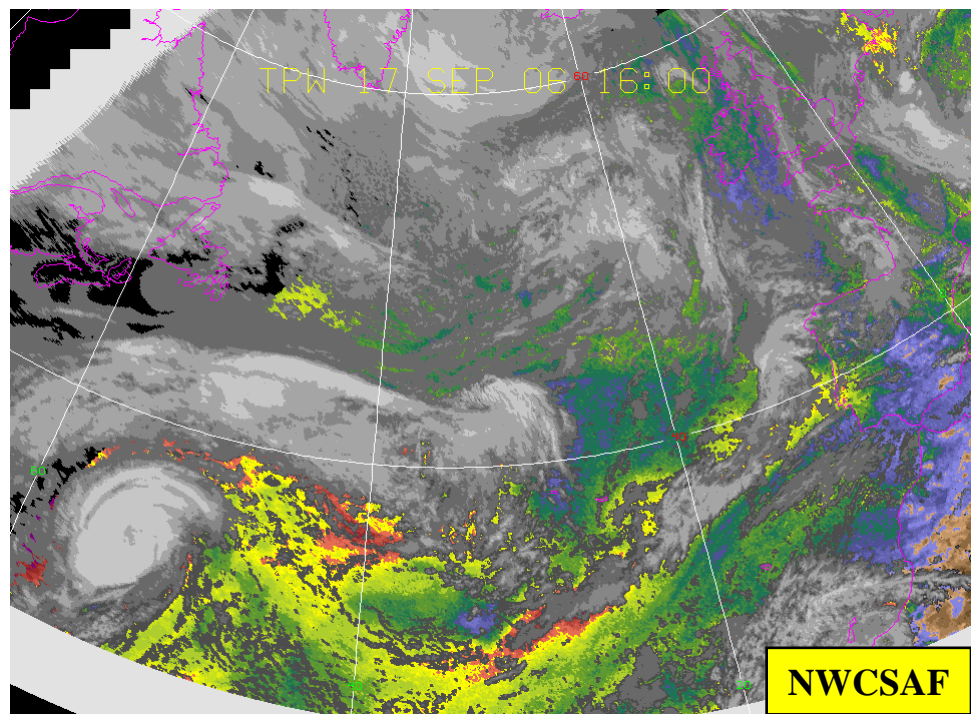




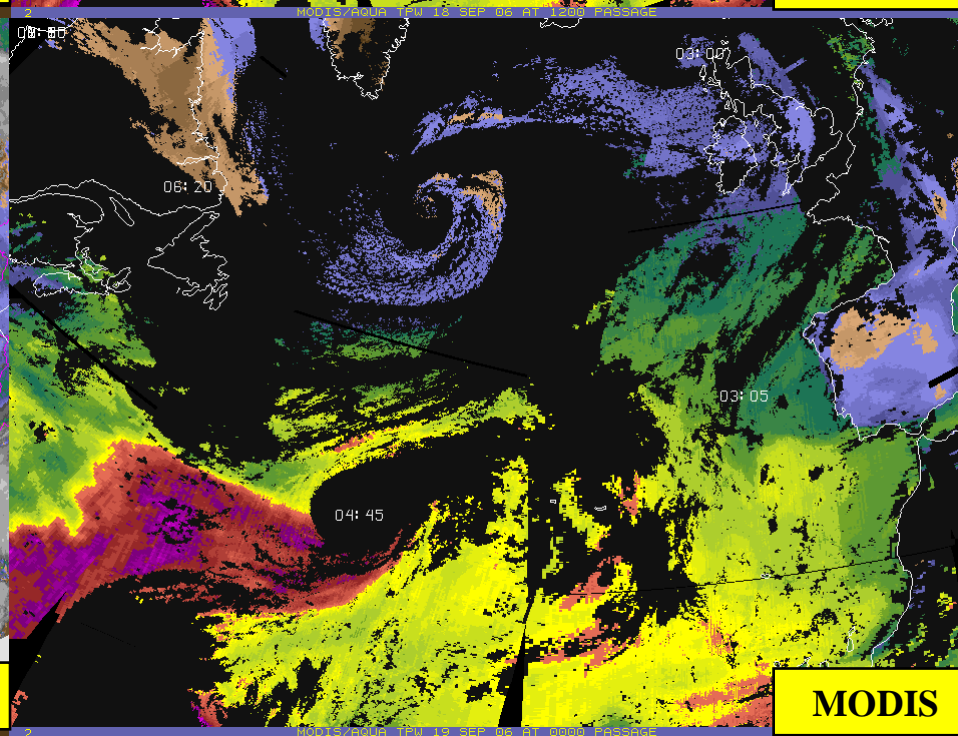
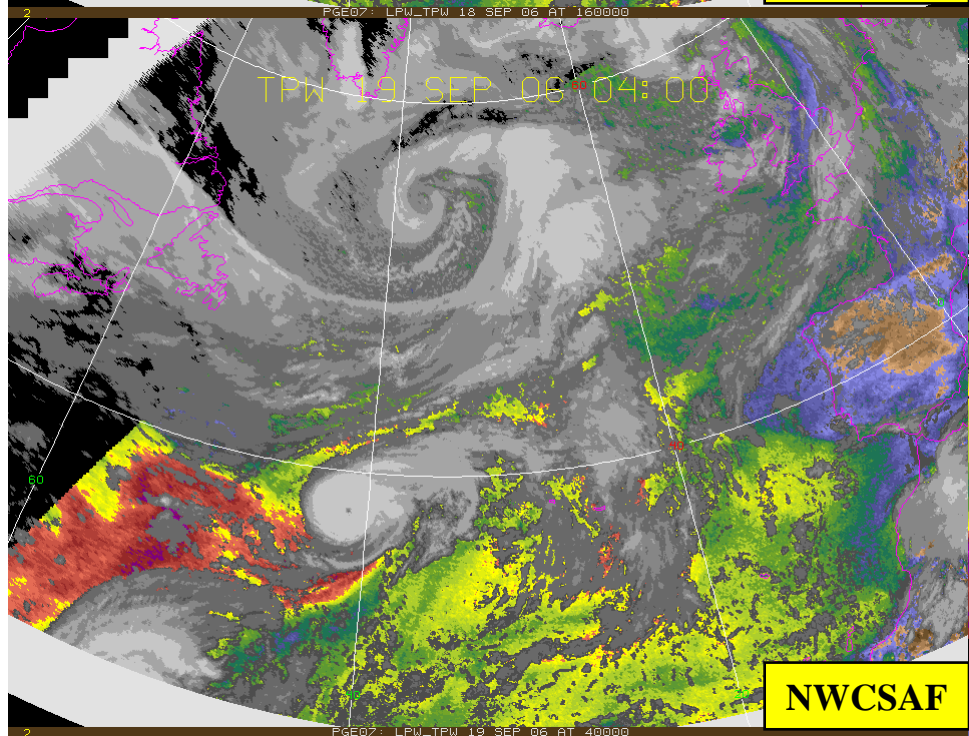
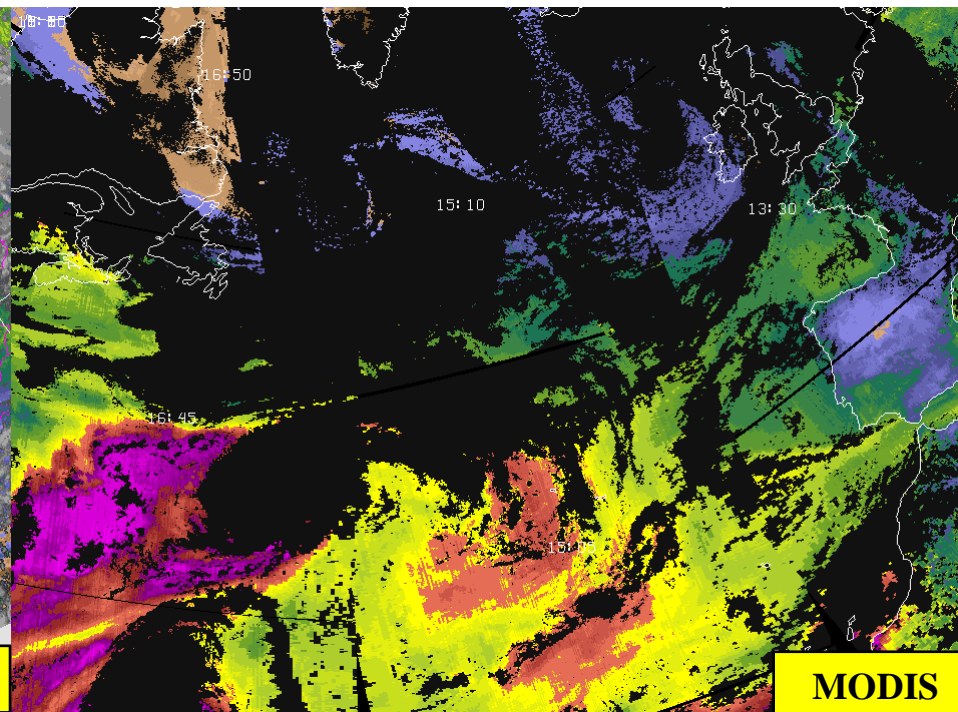
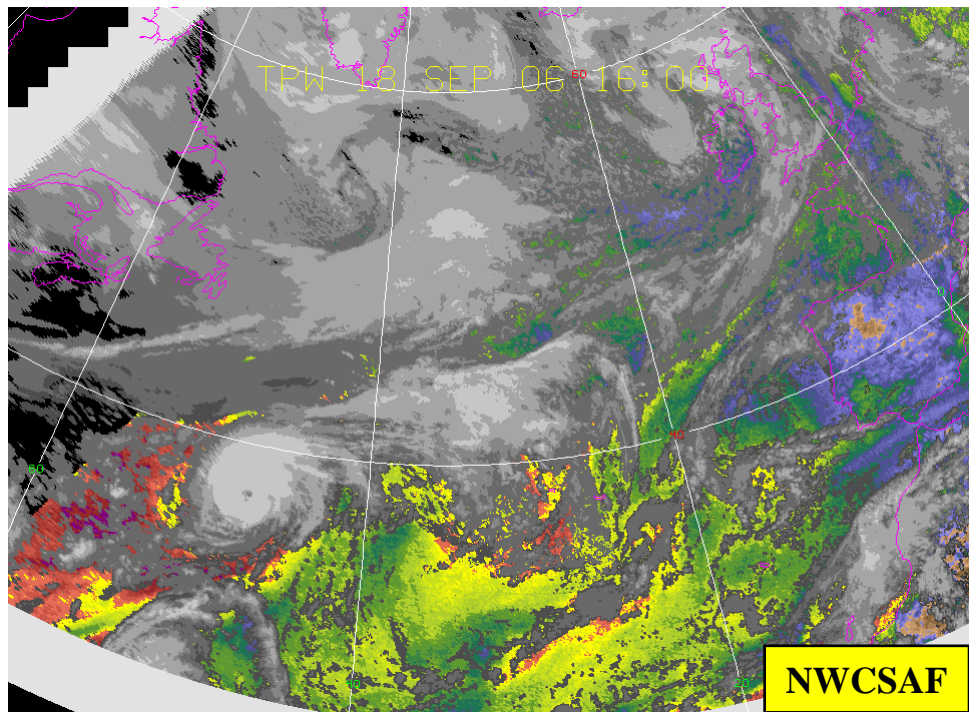
# GORDON Hurricane comparison NWCSAF/MSG TPW images VS MODIS/AQUA TPW



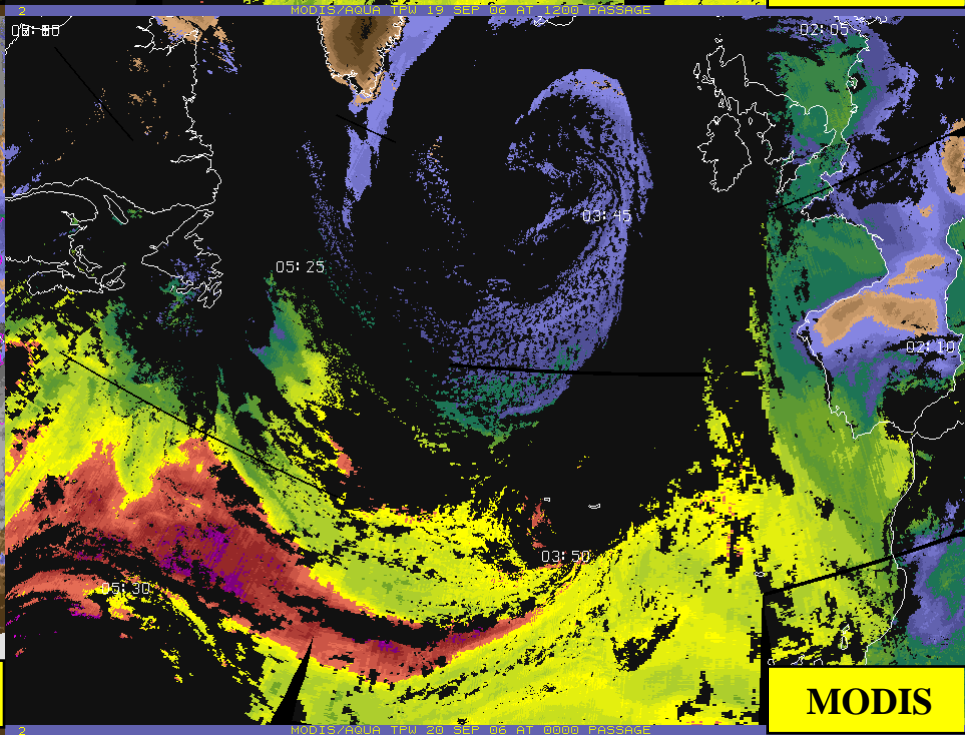
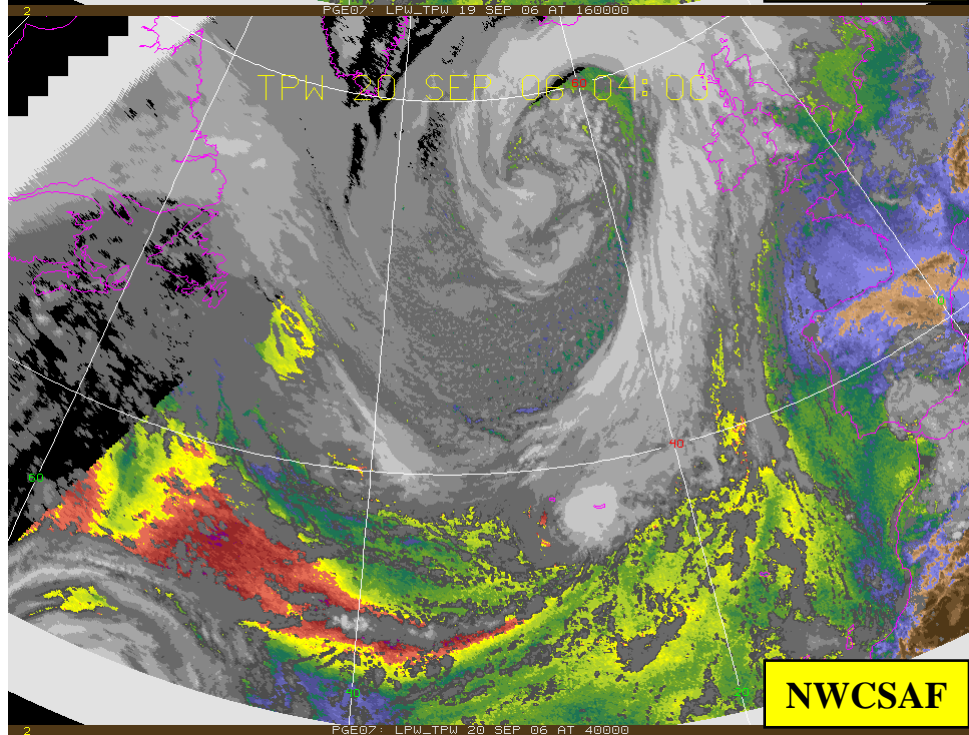
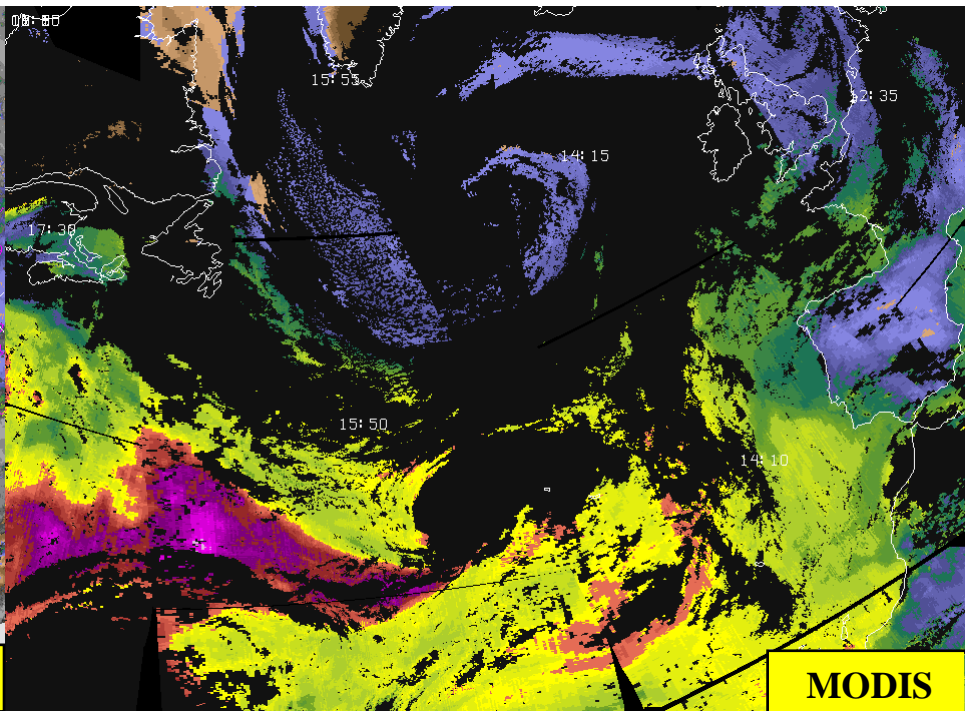
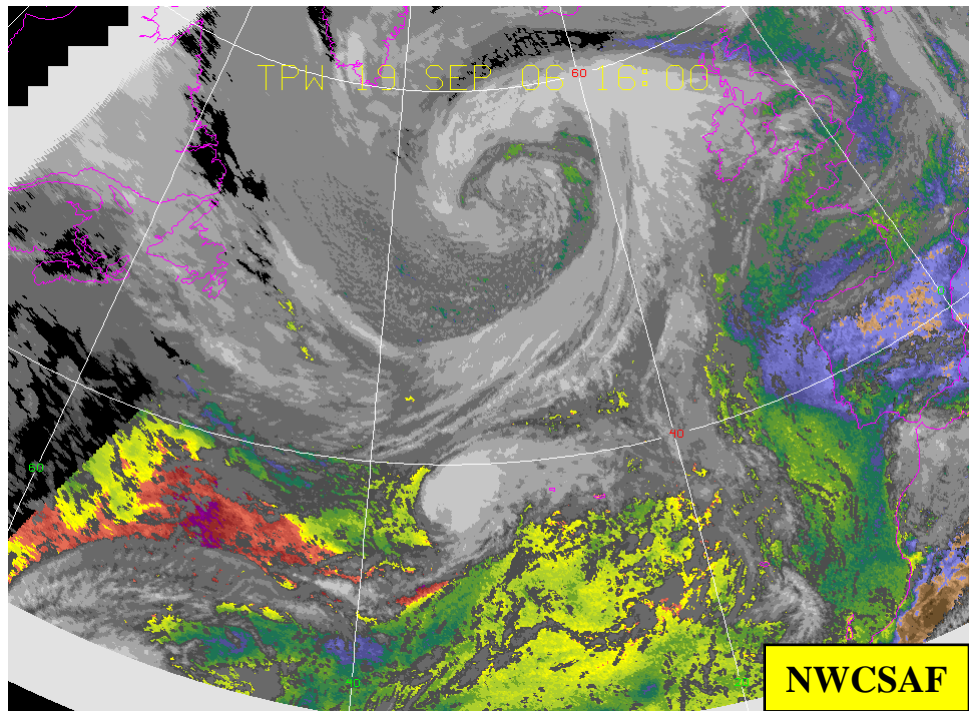




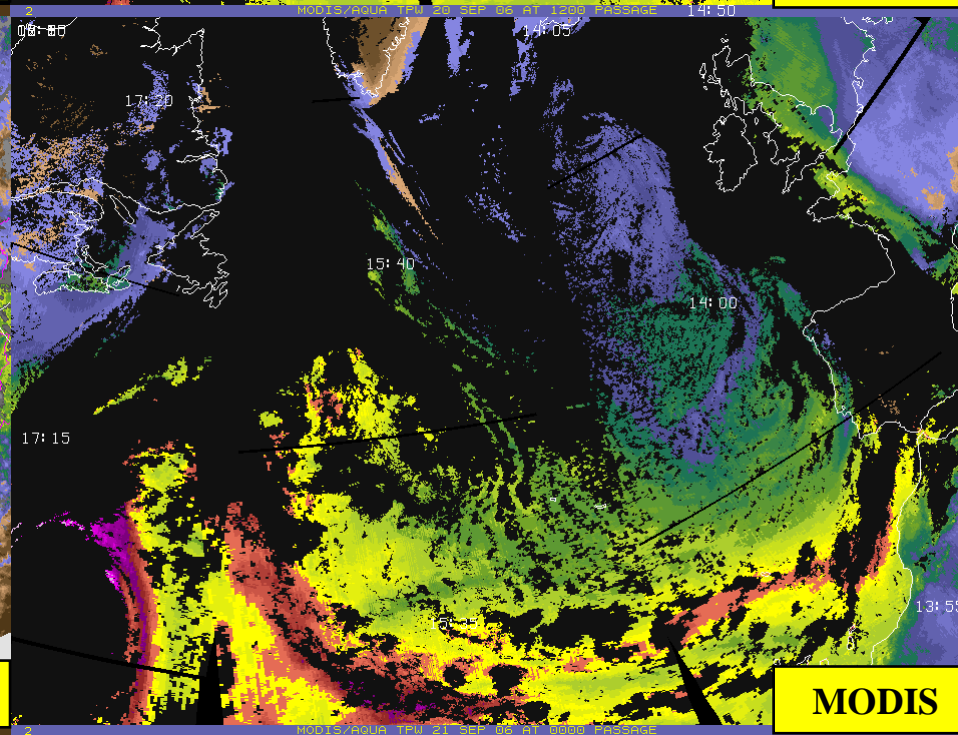
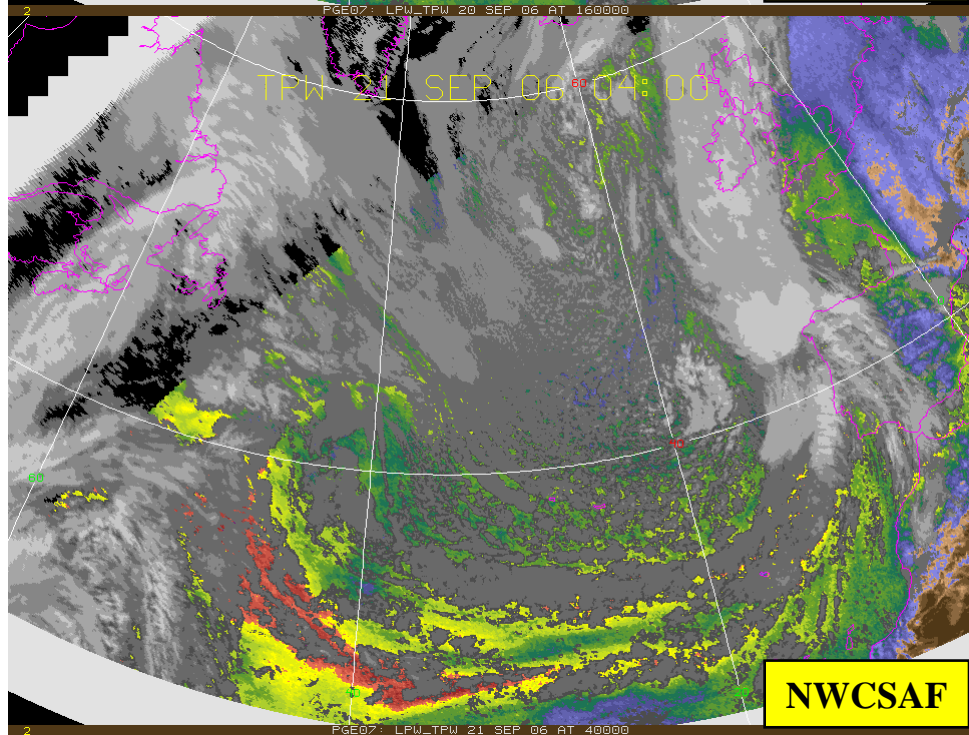
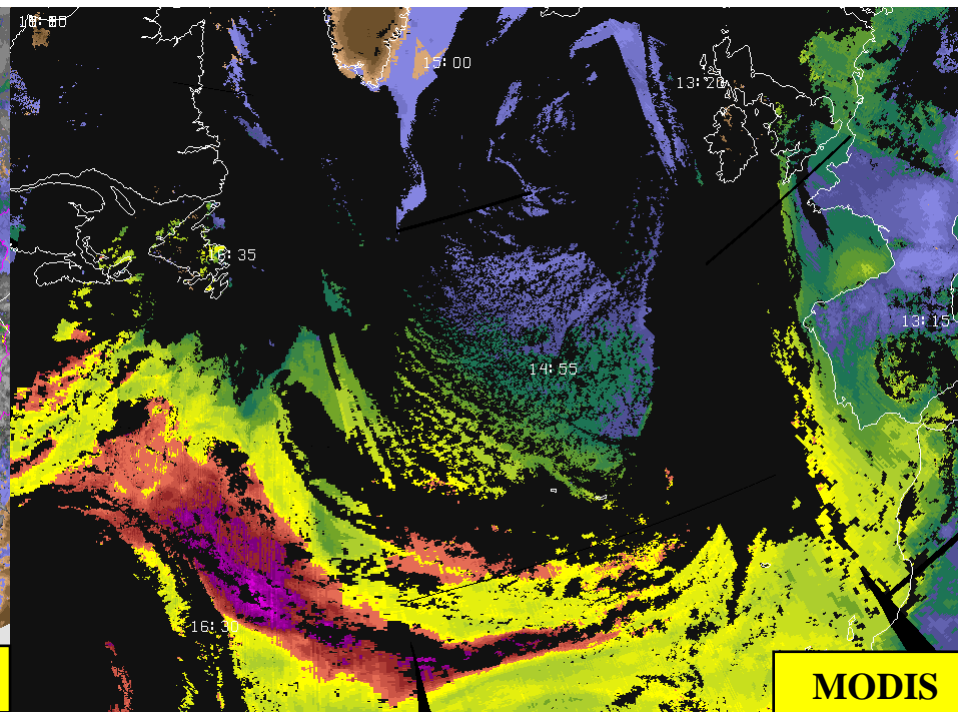
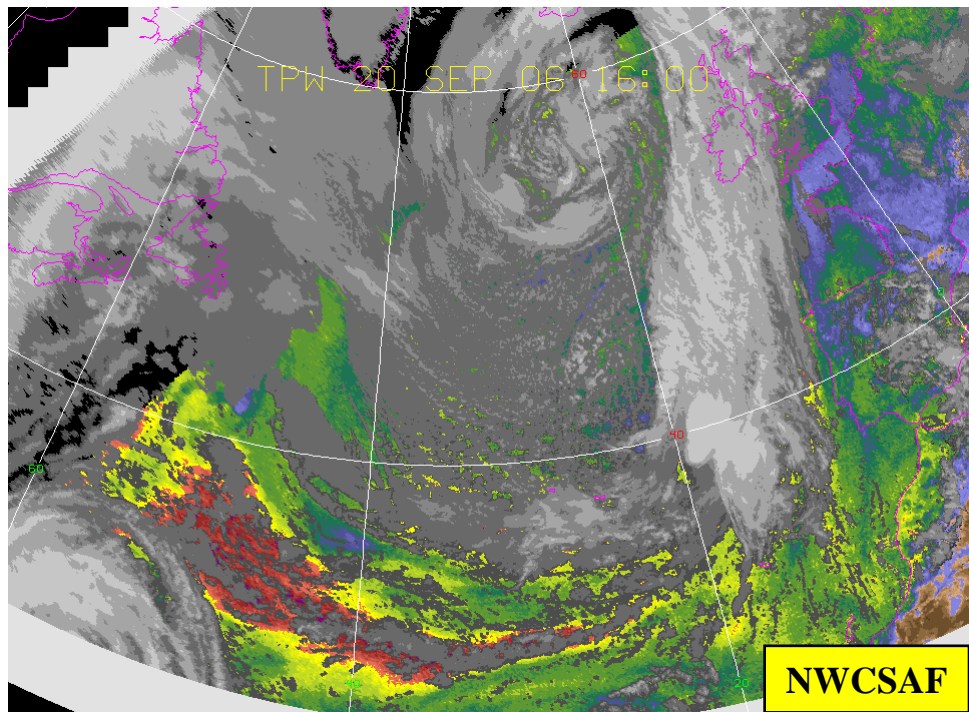














# Summary

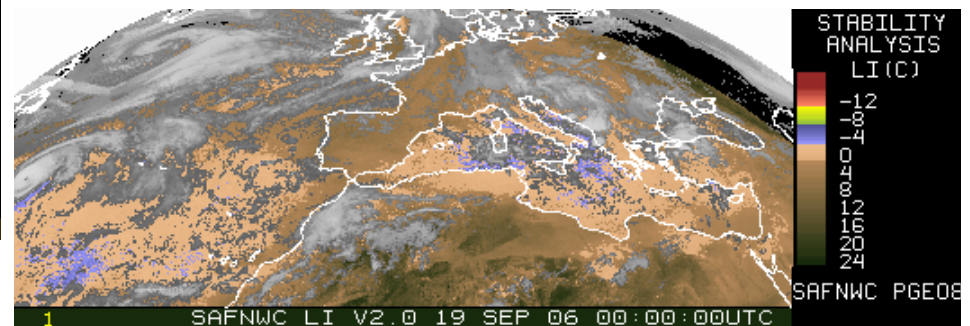
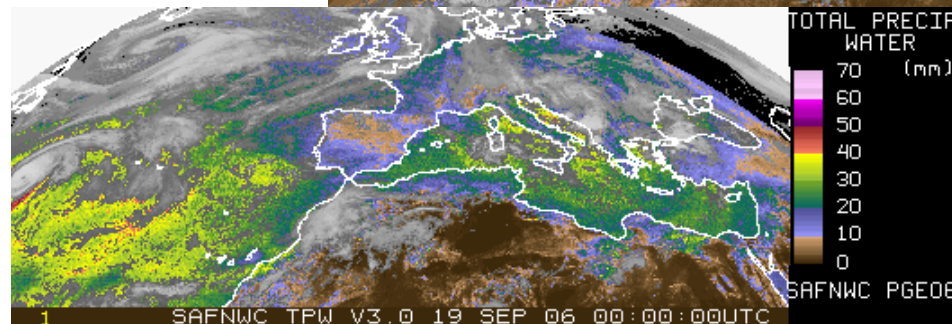
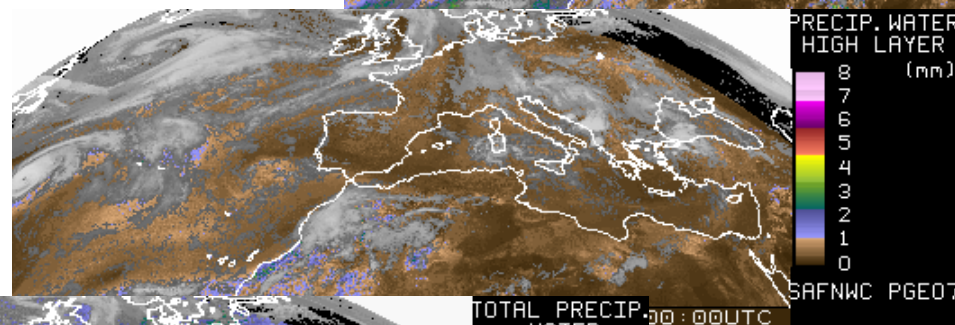
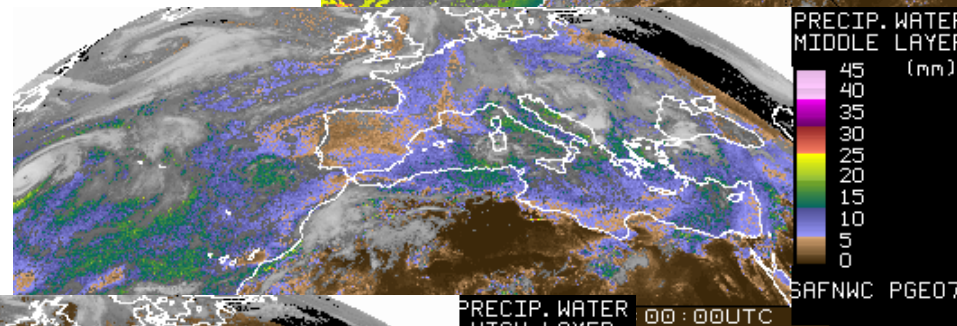
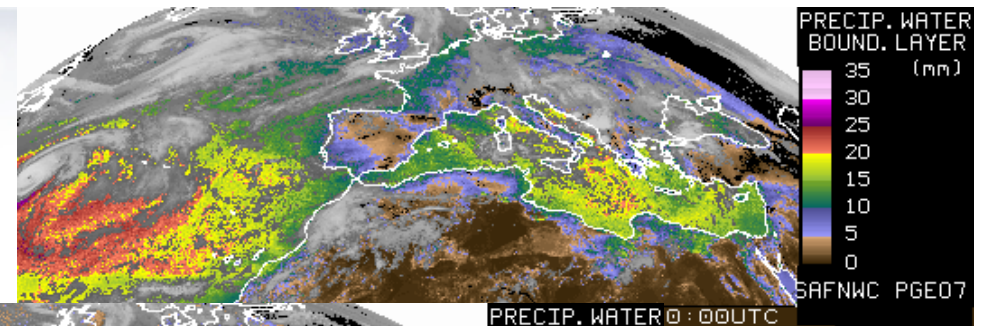
- The SAFNWC products have been shown during the GORDON Hurricane event.
- The SAFNWC products provide additional satellite information that is available for the meteorological community.

# Outlook

- **PGE13 based on “physical retrieval” for version 2009. Based on Visiting Science Activity of Dr. Jun Li (CIMSS University Wisconsin)**
- **New neural networks with training datasets using RTTOV-9**
- **Introduction of M1 and M2 layers in new versions.**

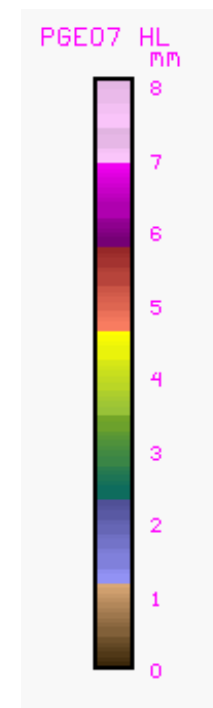
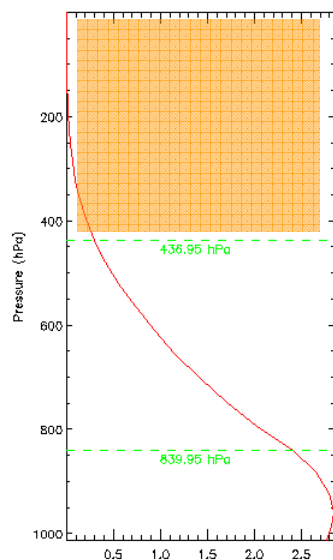


Thank you for your attention

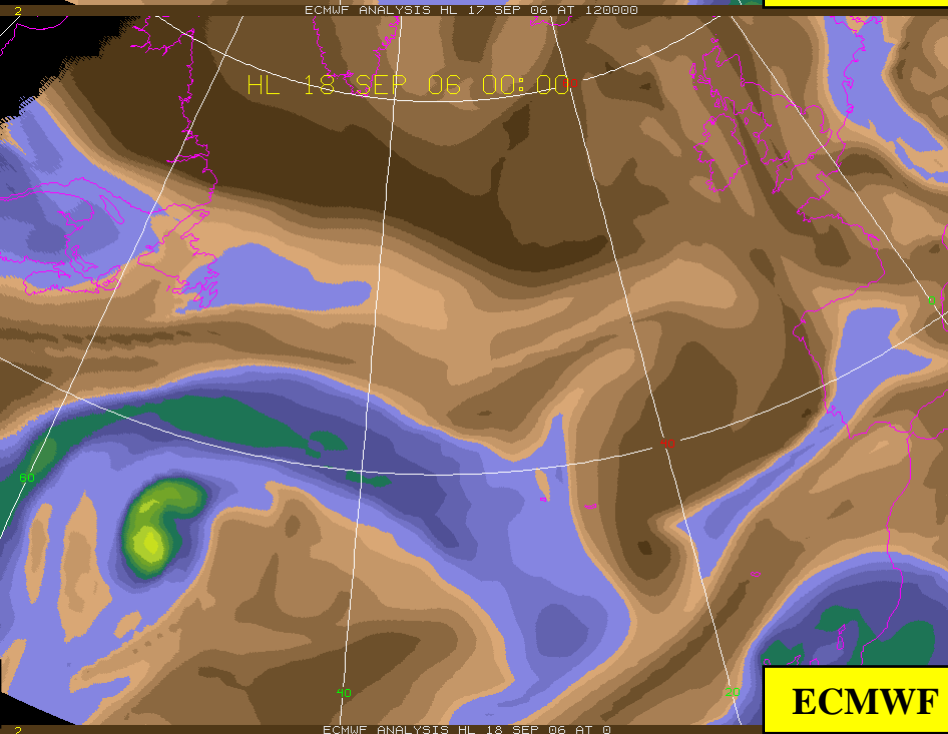
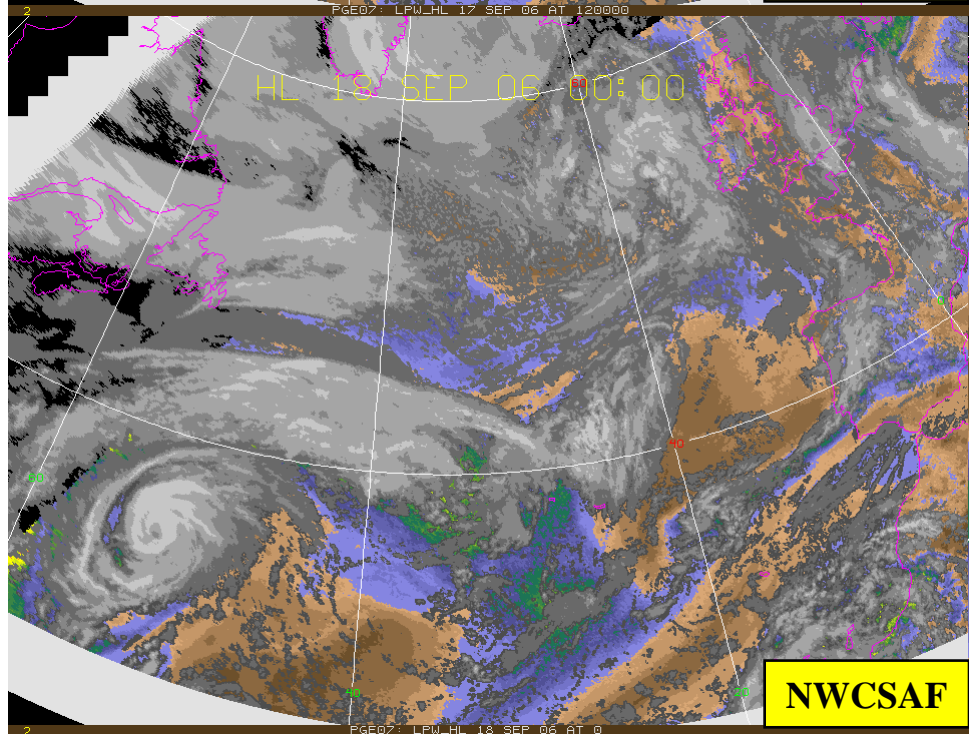
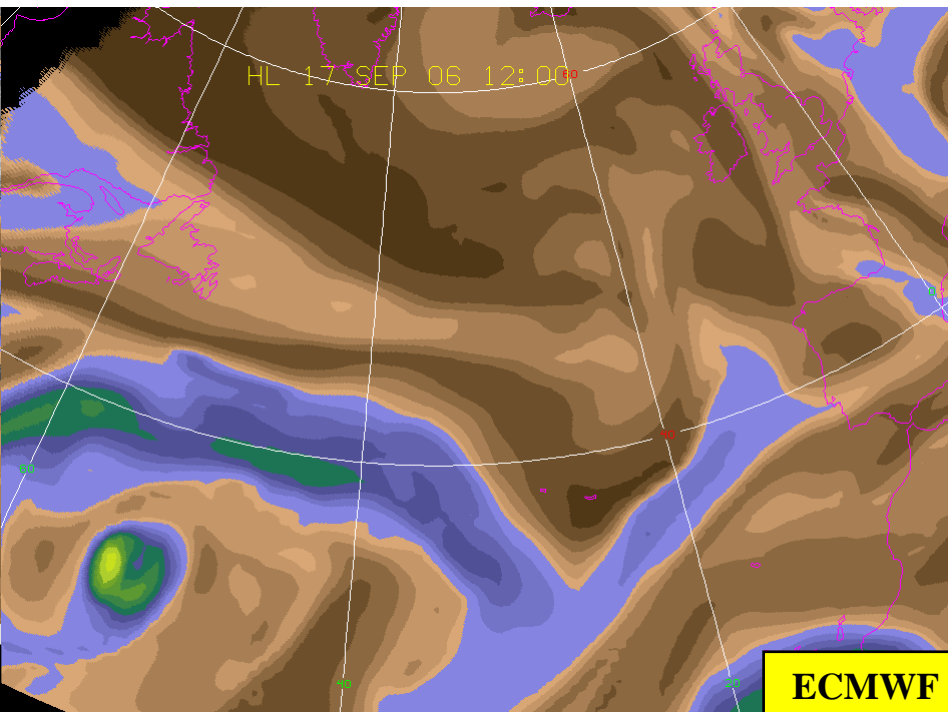
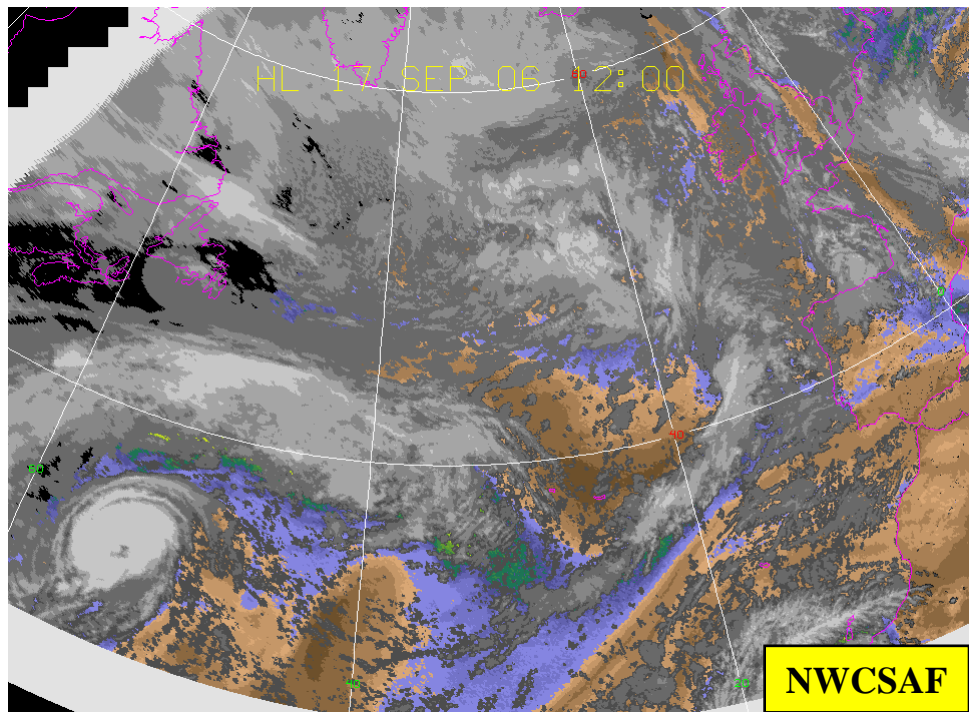


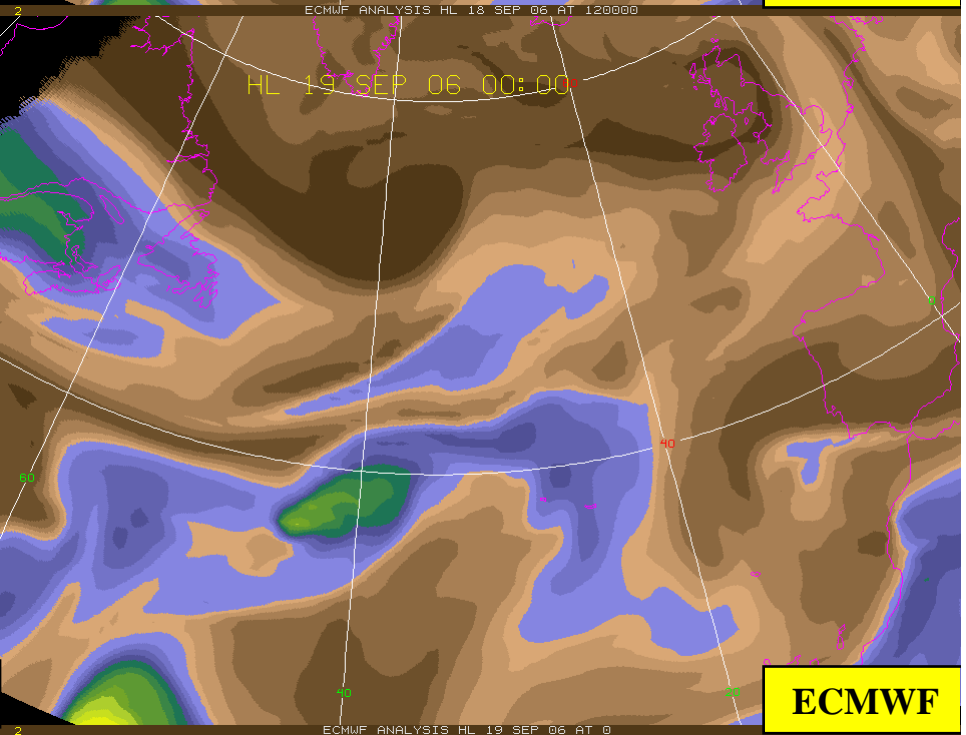
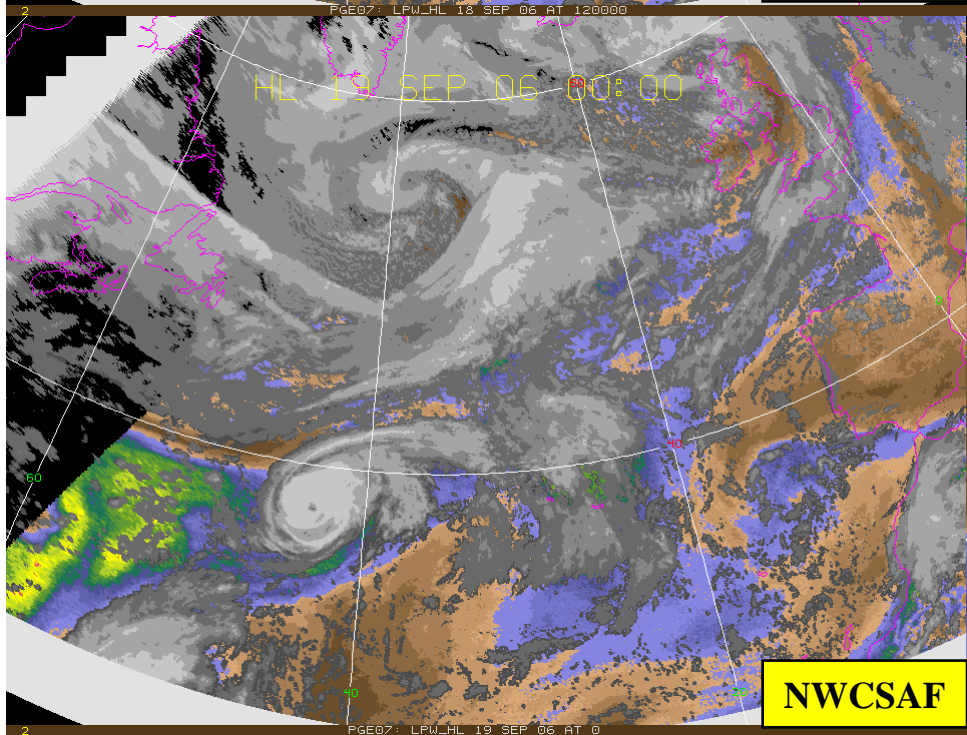
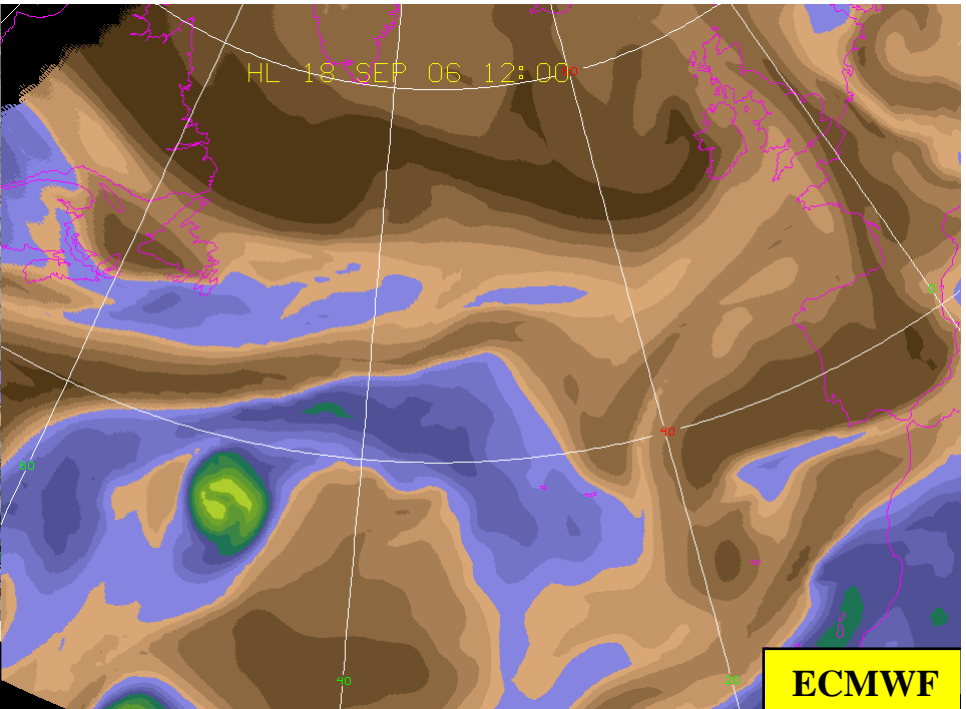
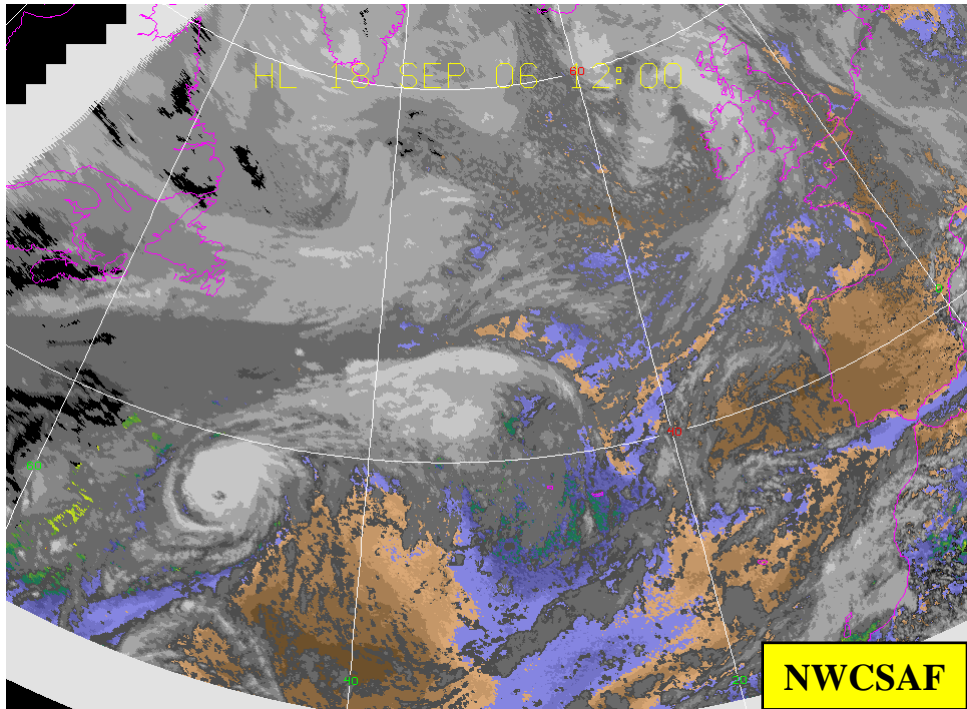
<http://nwcsaf.inm.es>

# GORDON Hurricane comparison NWCSAF/MSG HL images VS ECMWF HL High Layer (HL) ( $P < 437\text{hPa}$ )

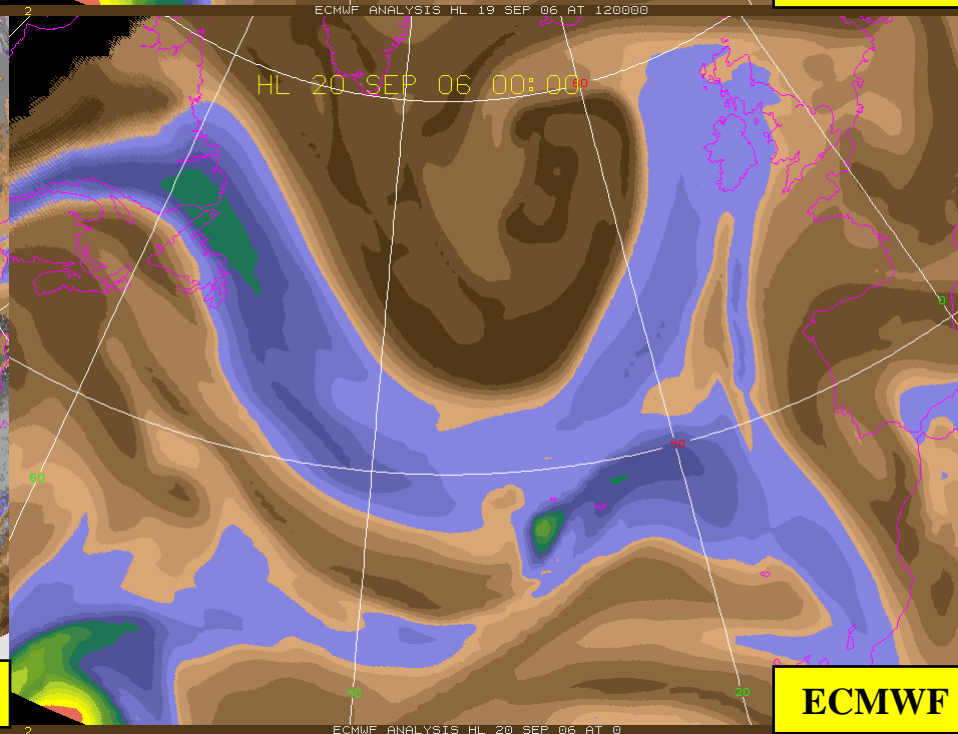
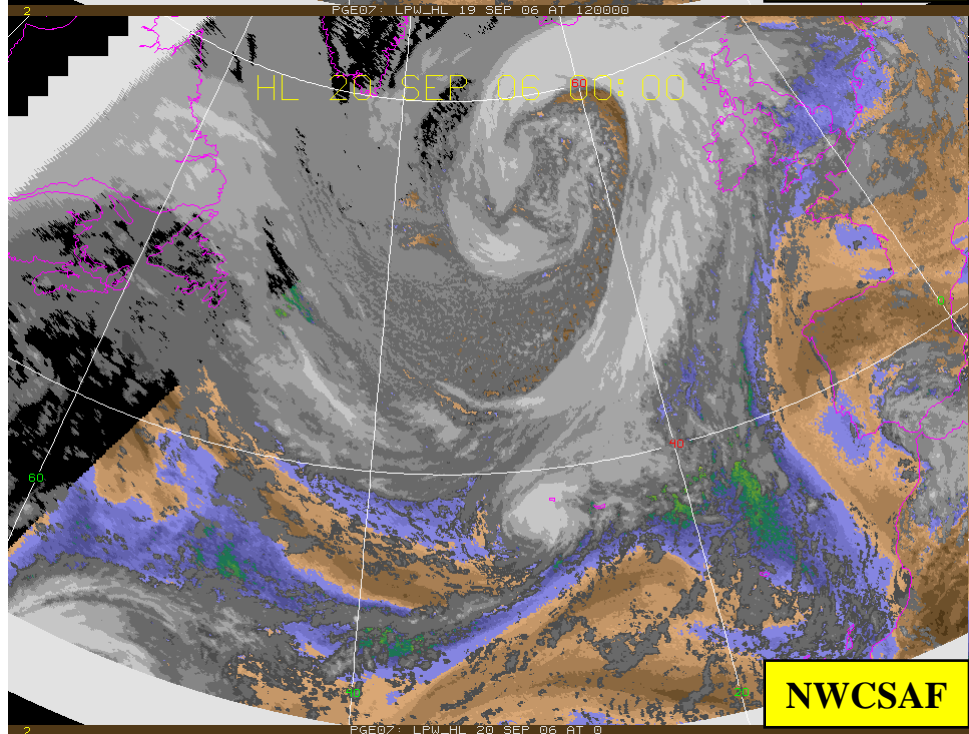
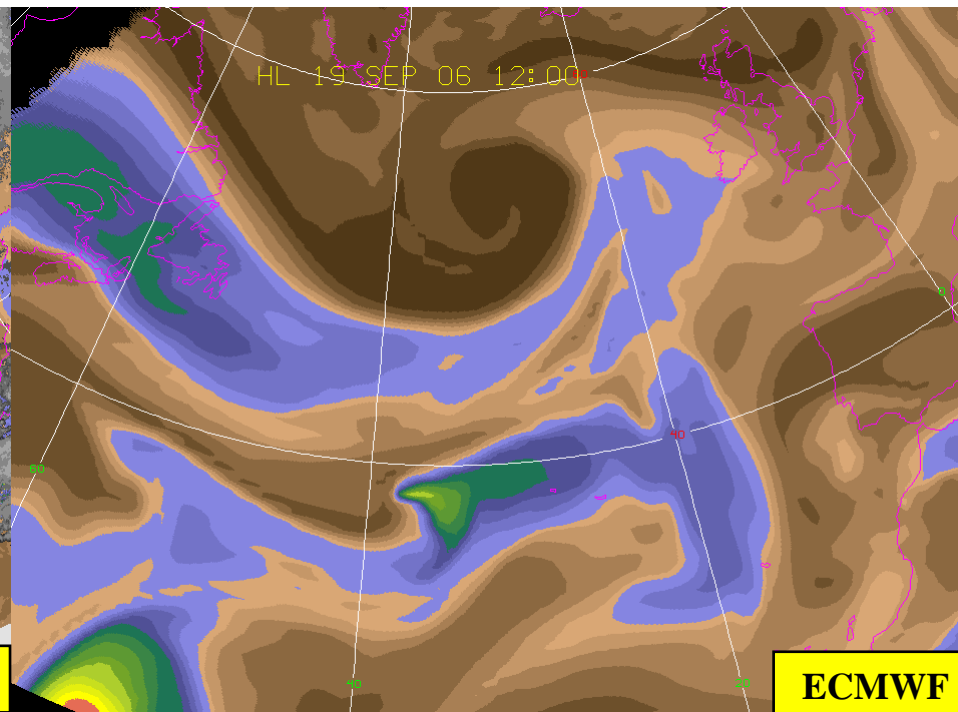
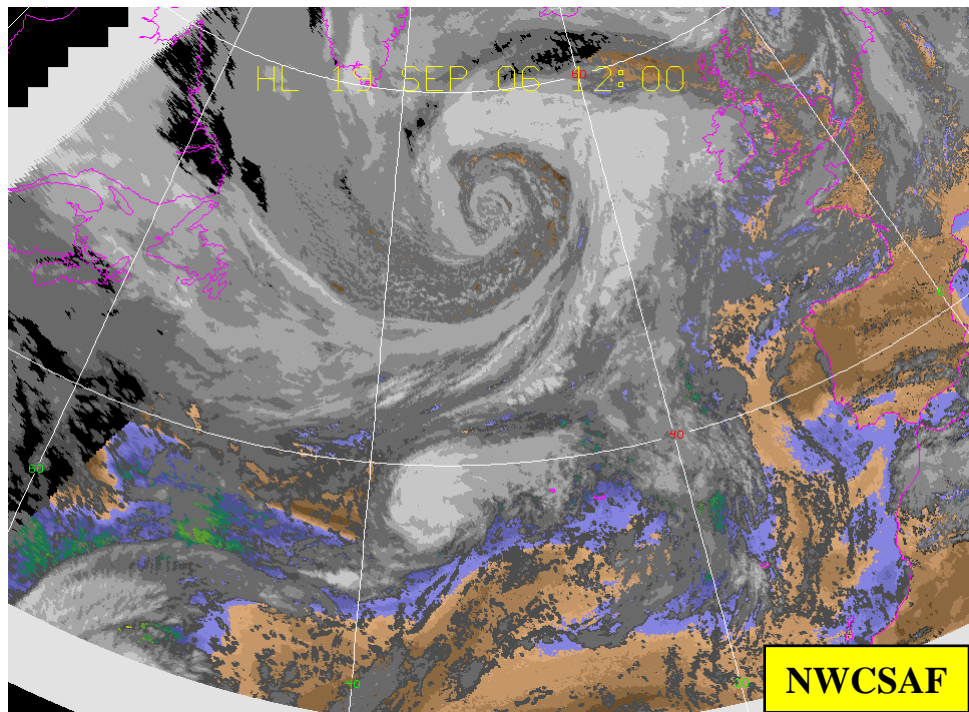


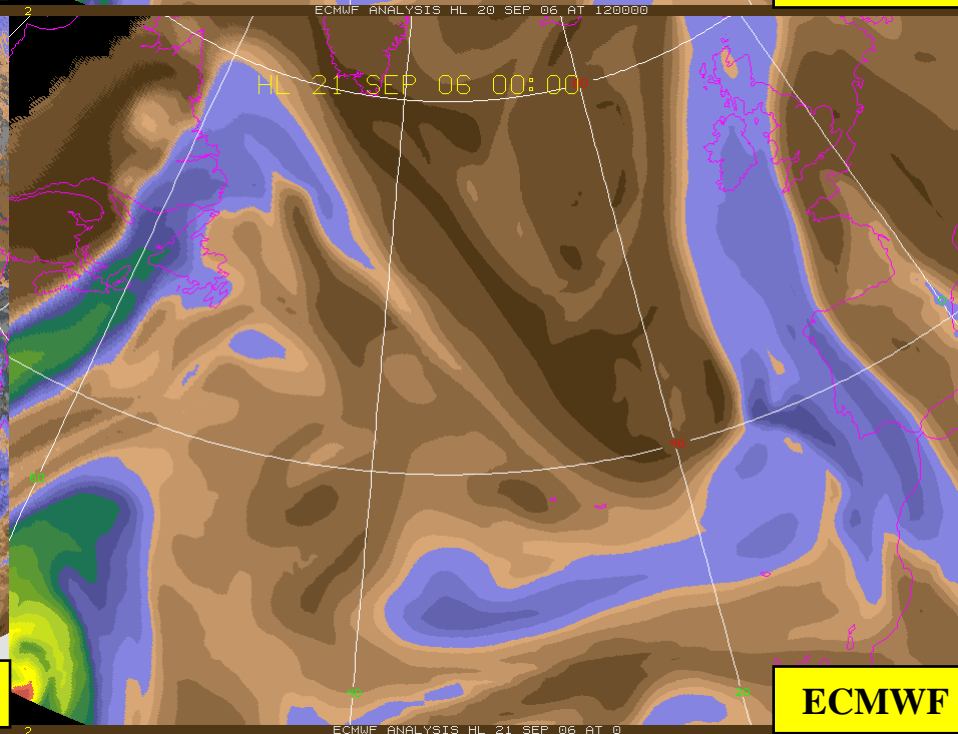
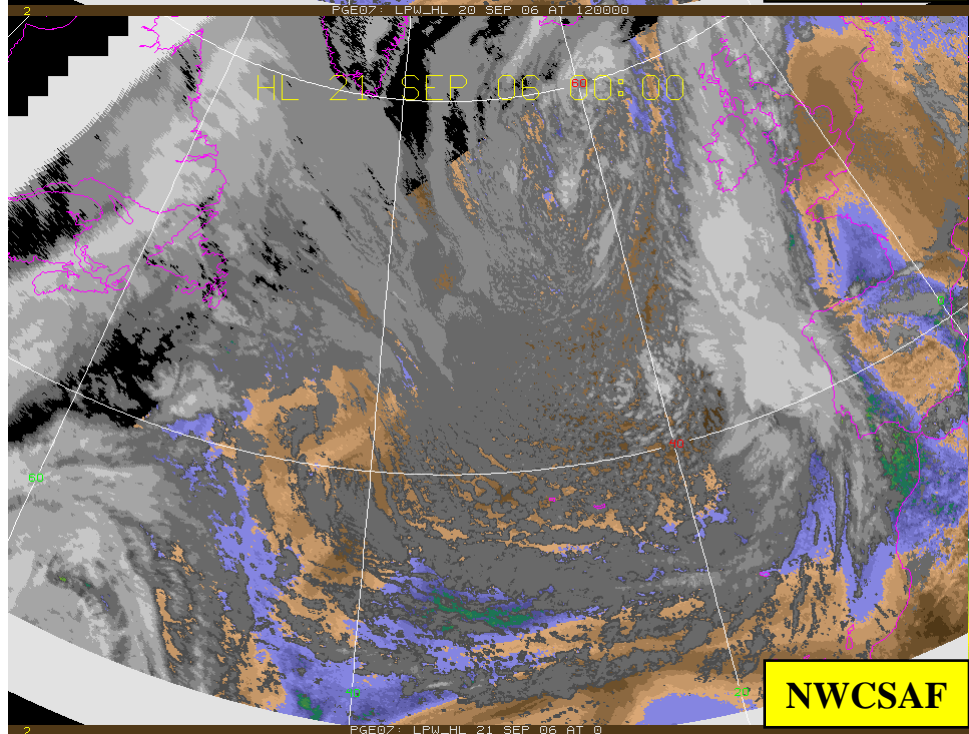
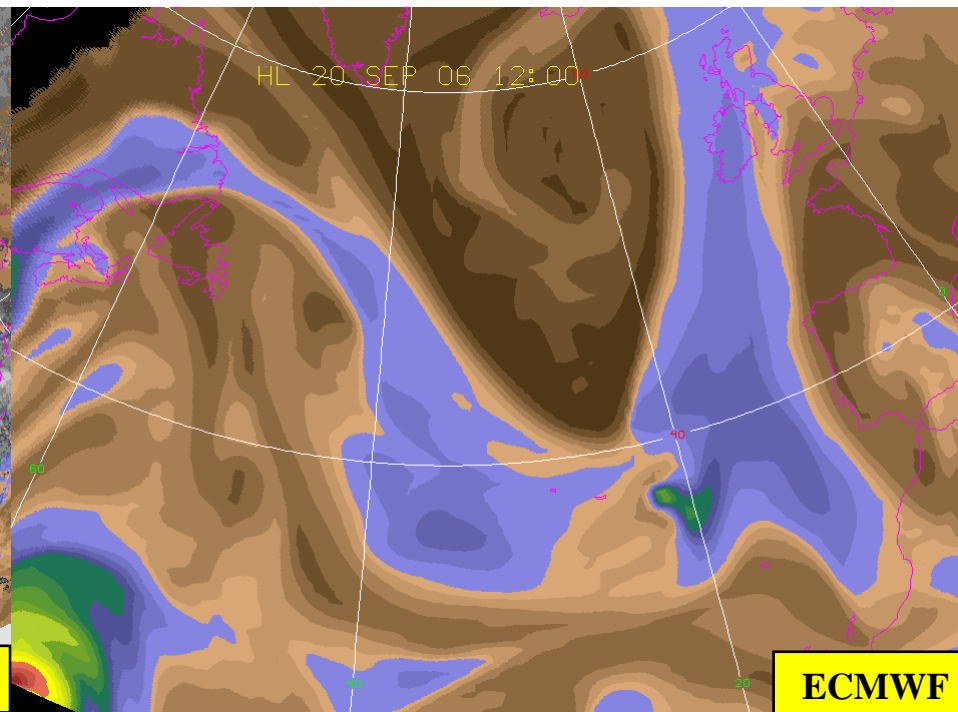
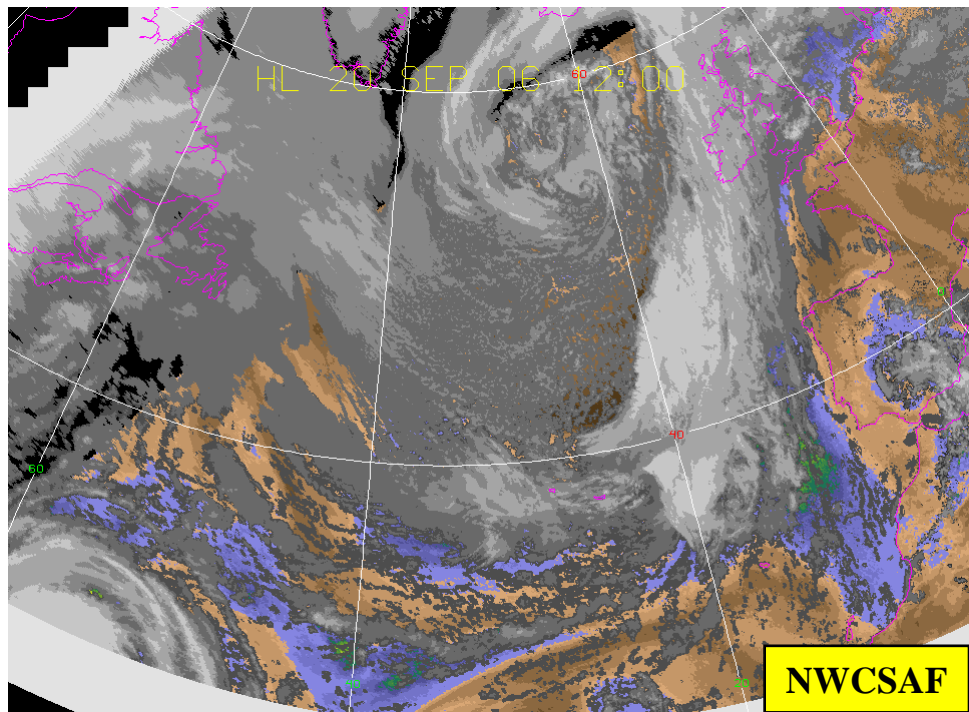














# GORDON Hurricane comparison NWCSAF/MSG SAI images VS ECMWF LI

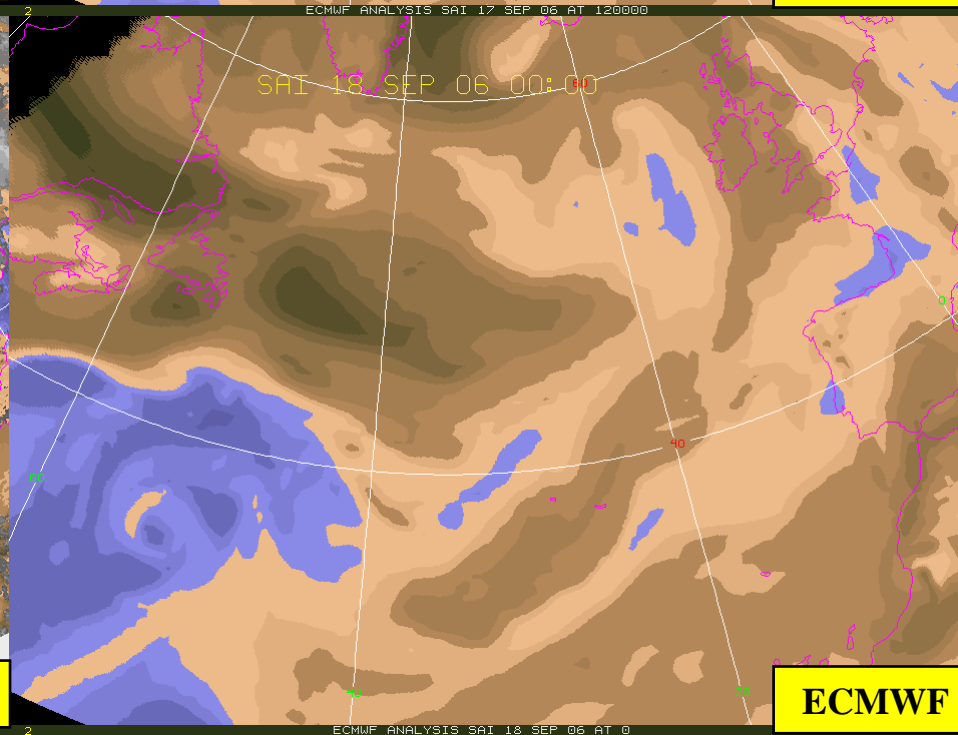
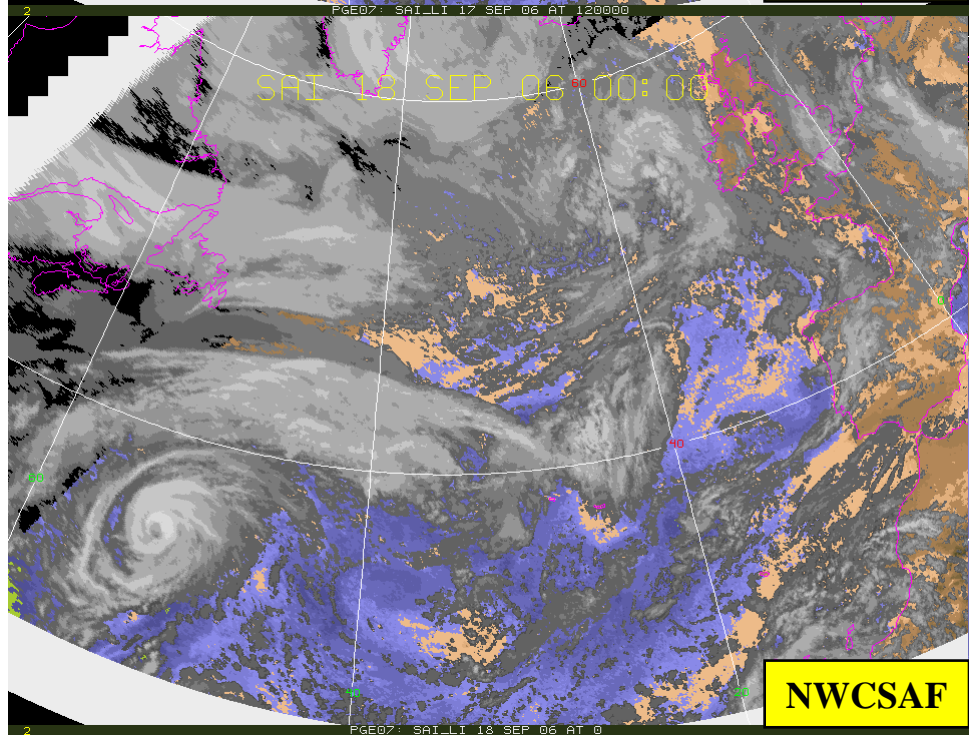
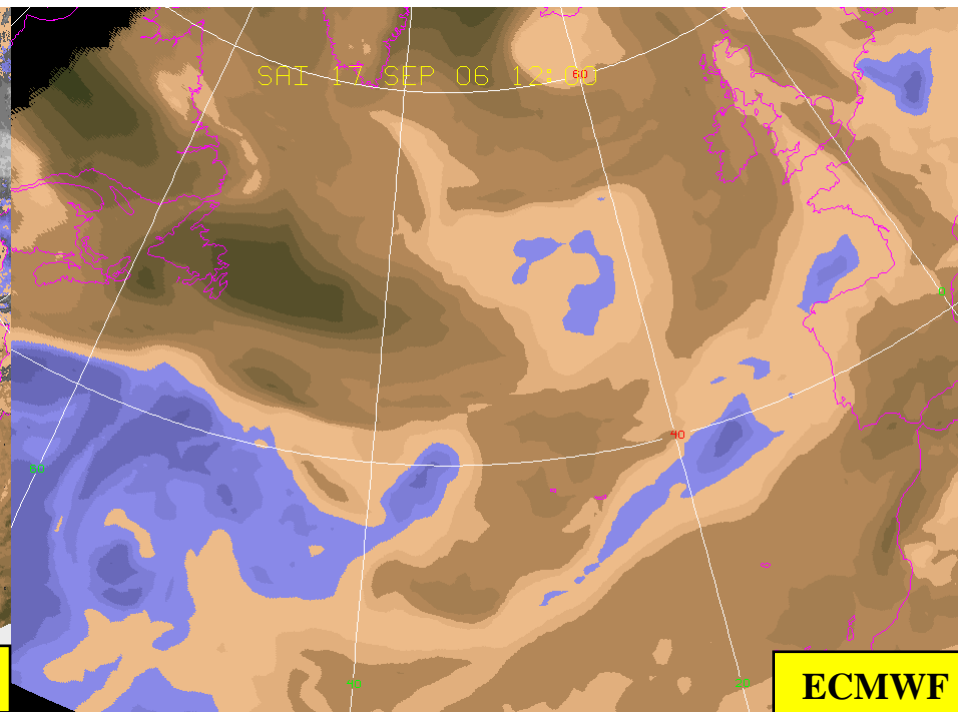
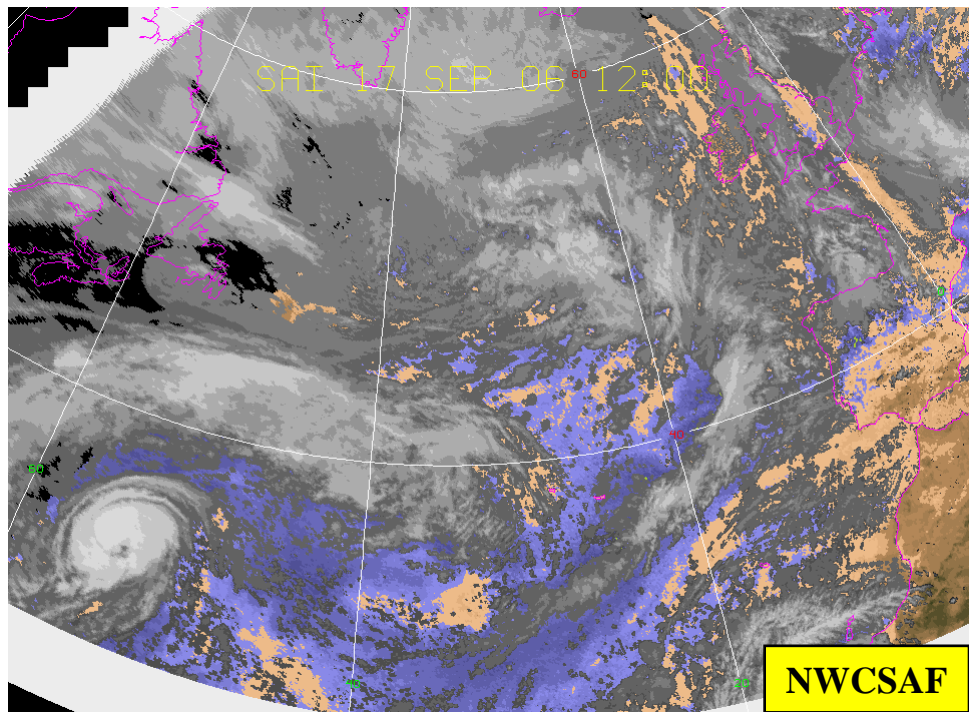
SAI provides estimations of the atmospheric stability in cloud-free areas. Among all the potential indexes, the Lifted Index (LI) has been implemented and coded.

PGE08 SAI  
LI (°C)

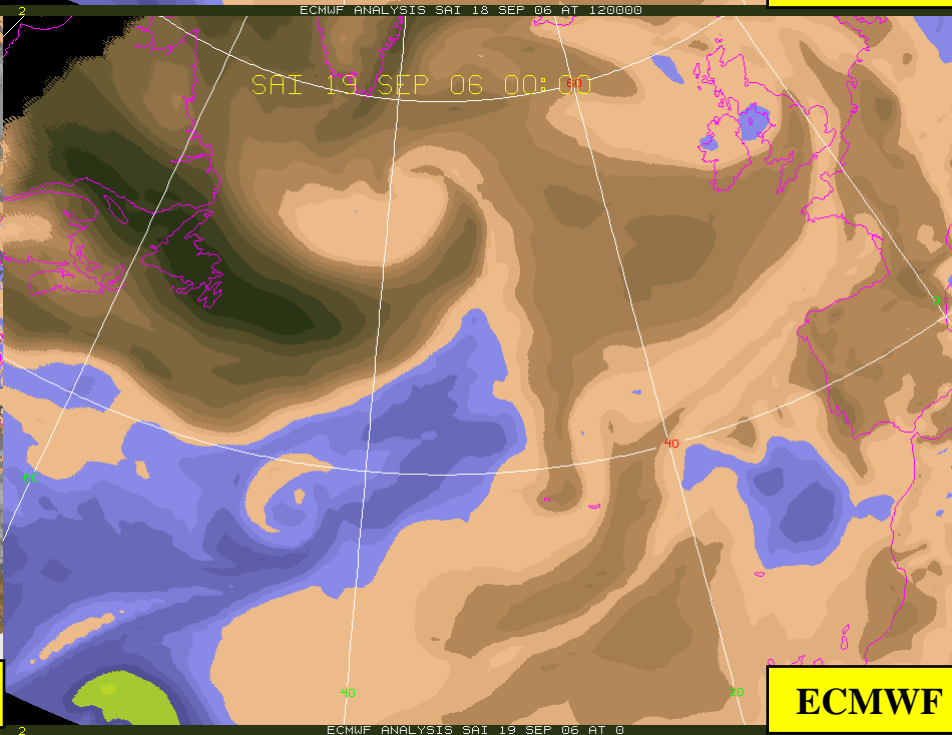
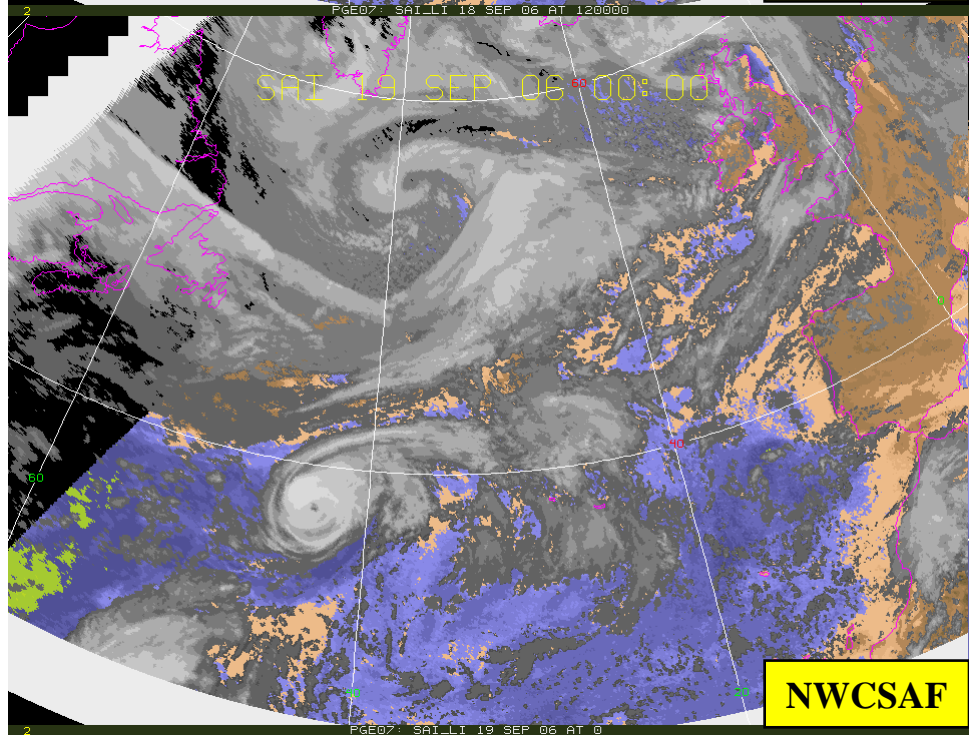
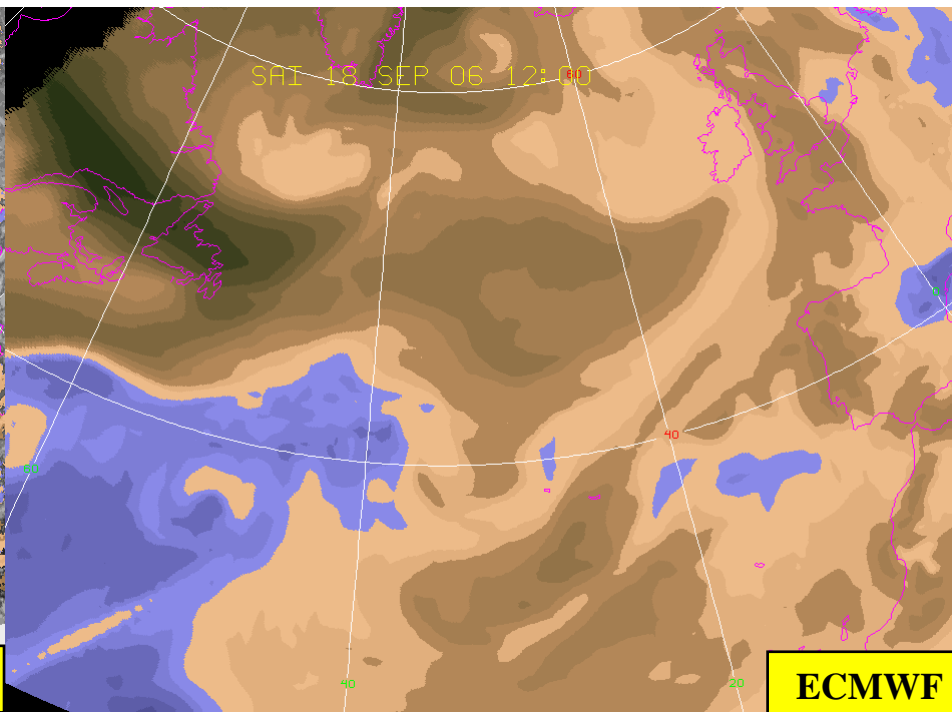
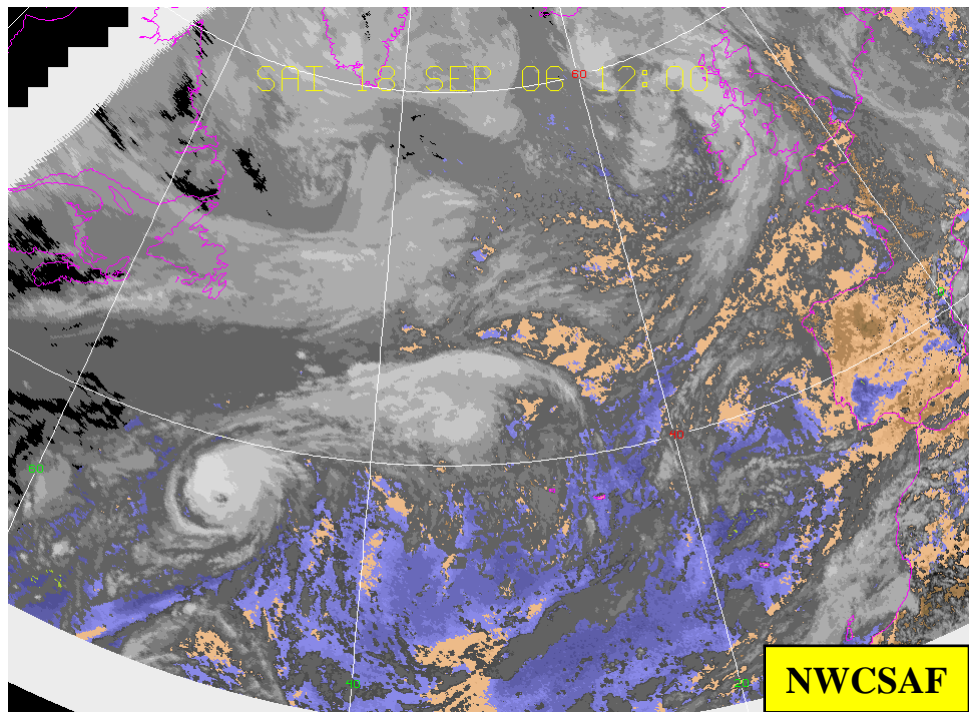


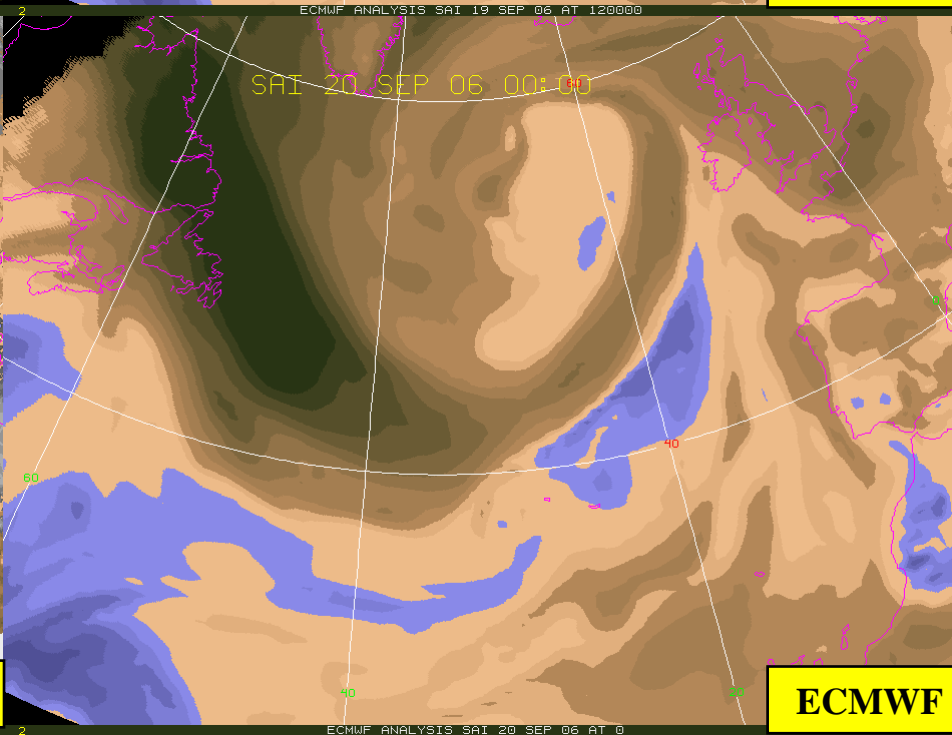
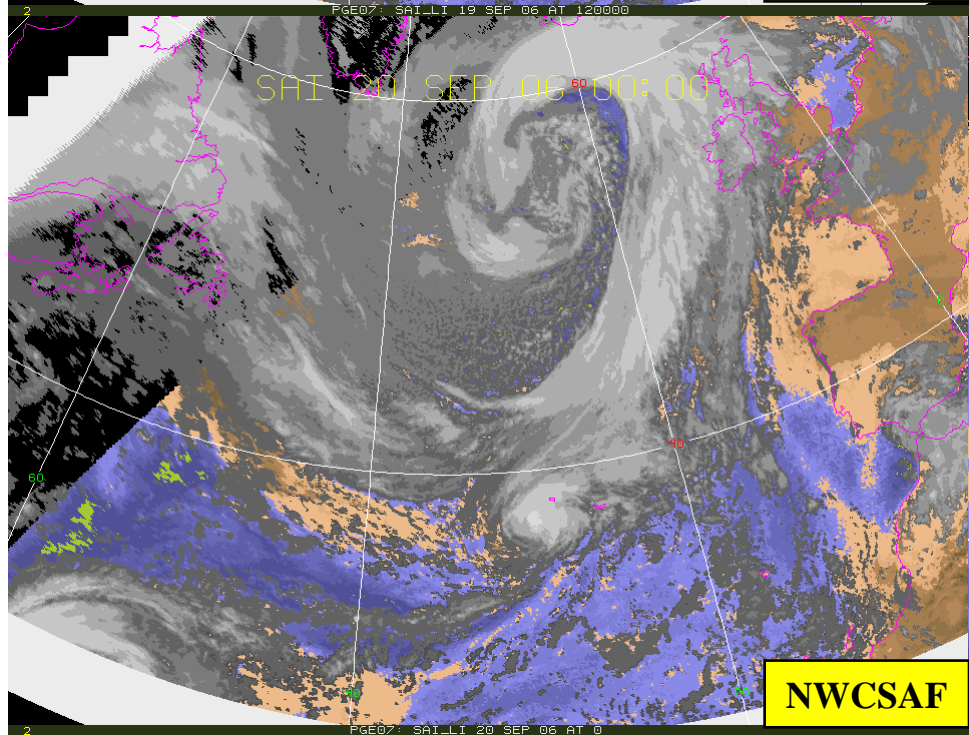
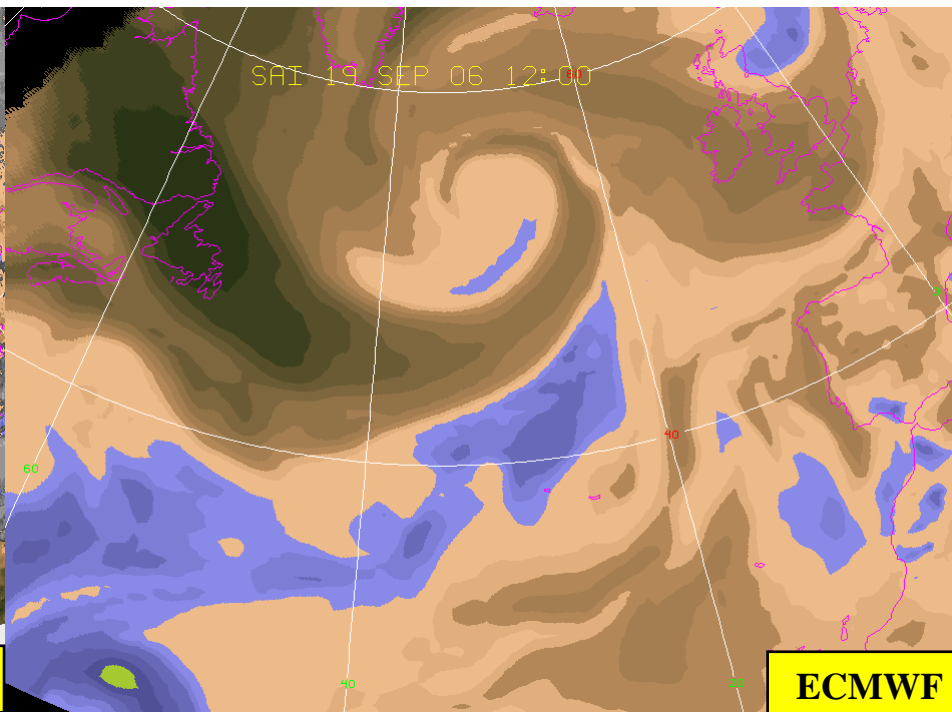
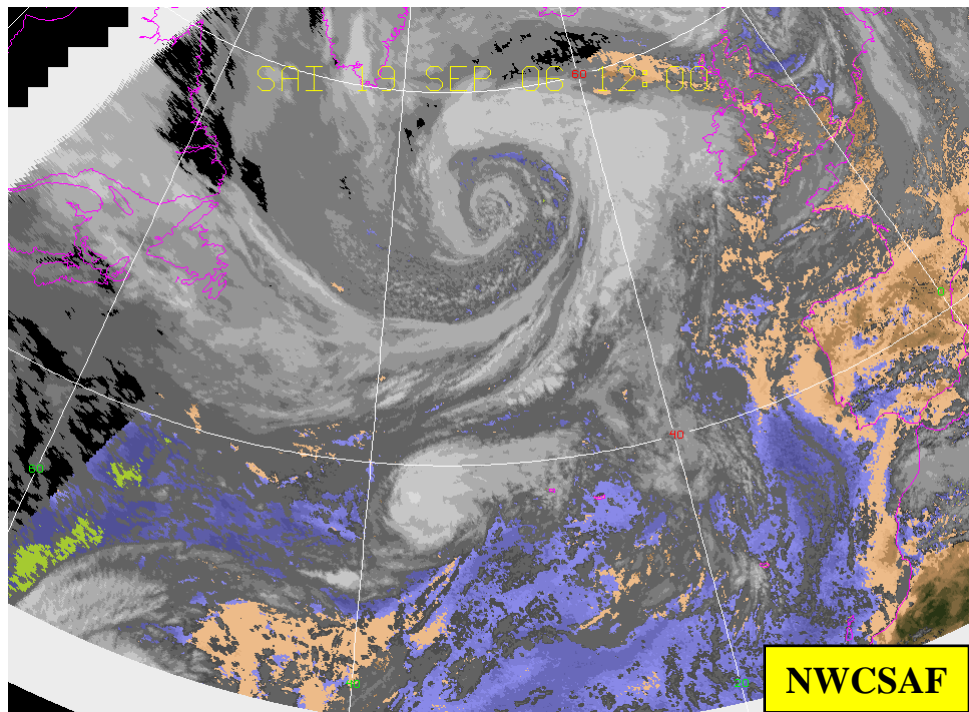
SAI\_LI

$$LI = T (500\text{-hPa environment}) - T (500\text{-hPa parcel}) \text{ (in } ^\circ\text{C)}$$

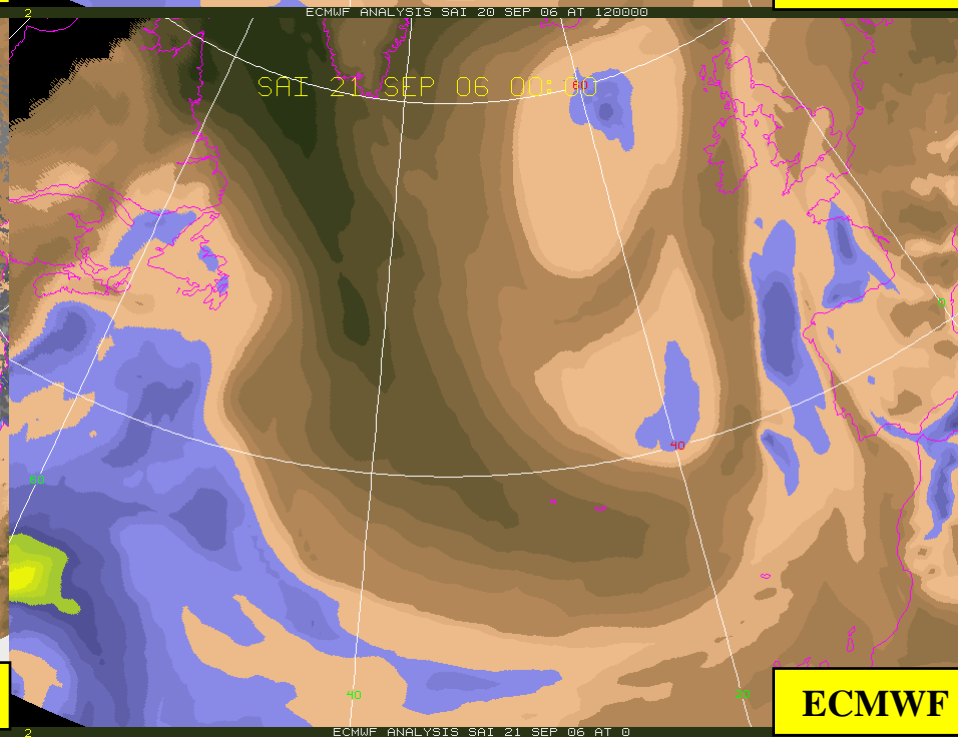
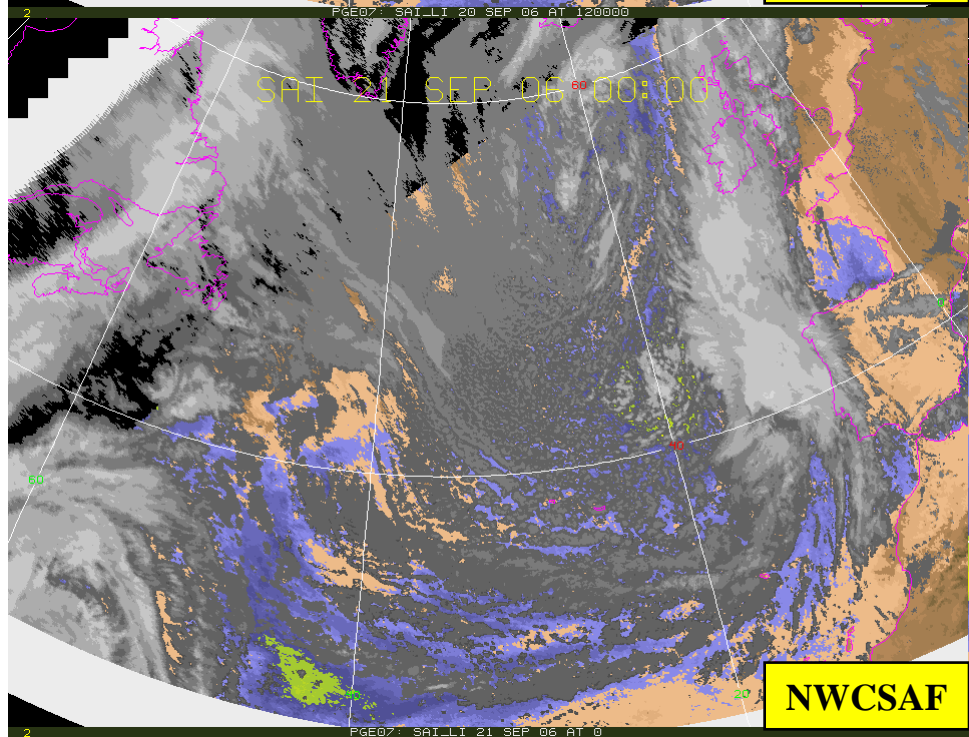
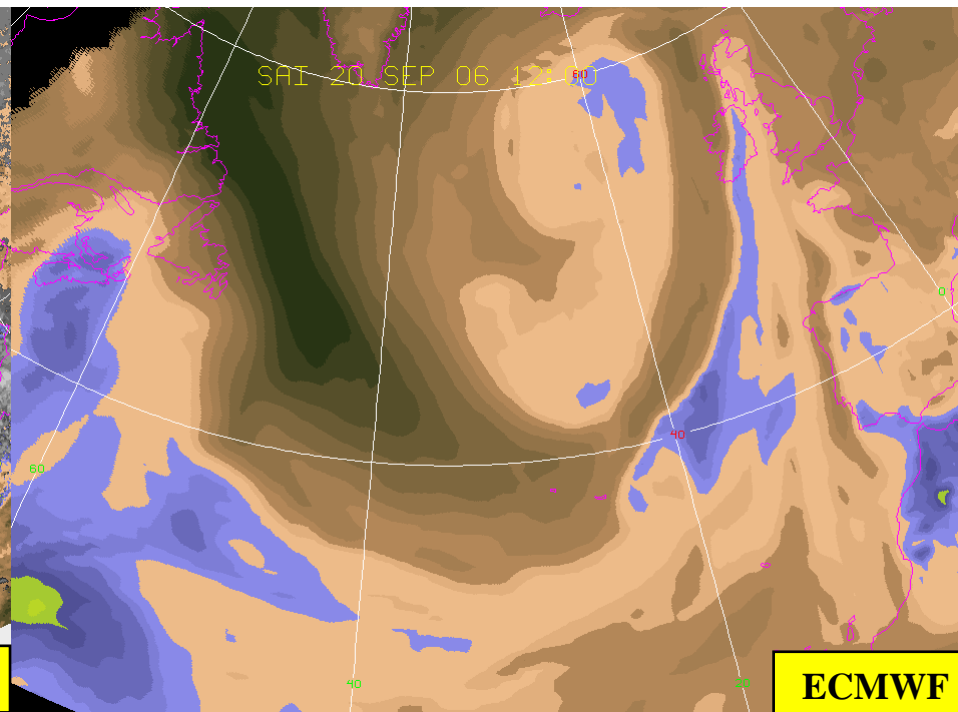
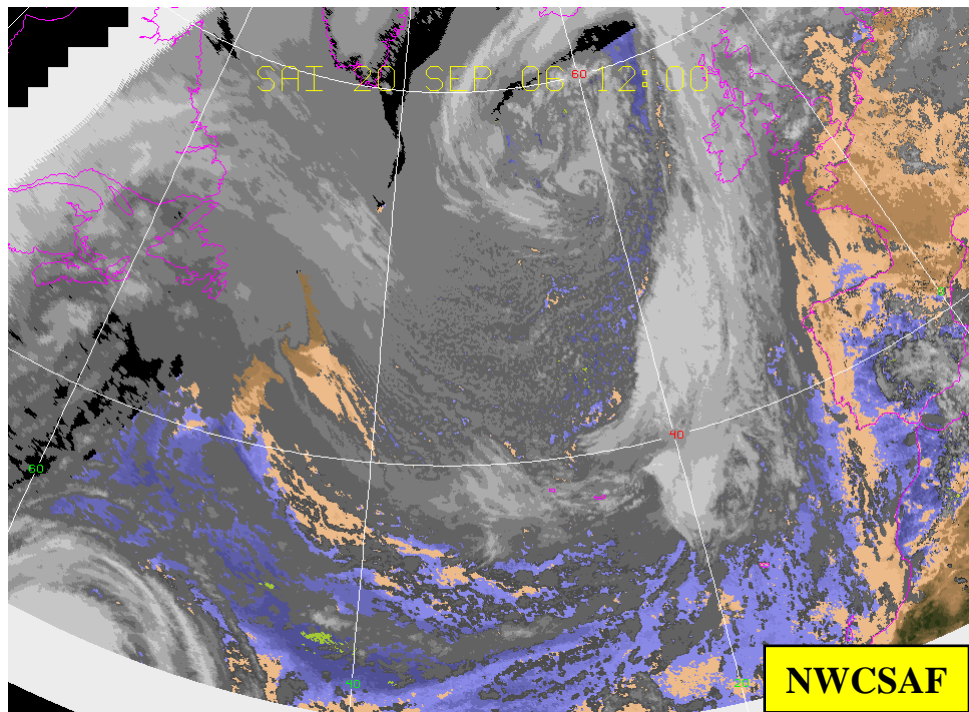












# Spectral Channels of Imagery Missions

